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GAS JOURNAL

LIGHT ♦ HEAT ♦ POWER ♦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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VOL. CLXX., No. 3232.] WEDNESDAY, APRIL 22, 1925. [77TH YEAR.

EDITORIAL NOTES.

Education Scheme Difficulties and Their Treatment.

No innovation such as the Education Scheme for staff members or those training for official appointments in the gas industry can be introduced without some difficulties arising which have to be negotiated. Some time ago we referred to what has been done to correct the original scheme in respect of deficiencies in meeting circumstances which experience had brought to light. The scheme as revised, and as approved by the Council of the Institution of Gas Engineers, the appropriate Government Departments of Great Britain and Ireland, and the City and Guilds of London Institute, has now been incorporated in a pamphlet; and in the current state of conditions, it is, we think, about as perfect as it can be made. The means adopted for overcoming such a difficulty as the want of educational facilities for applying the scheme as originally framed, it is hoped, will prove to be more or less temporary; but meantime we have to get the maximum benefit from the scheme in the ways that are most available. Those who have had this work in hand recognize that it would be most unfair to aspirants for examination and certification honours who, by reason of the disabilities placed upon them by geographical situation and far removal from educational centres where work complying with the scheme is in operation, might be denied facilities for gratifying their legitimate ambition. That there are many such young men in the industry is a matter for congratulation, as it shows the existence of the right spirit, and an appreciation by them of the value of the knowledge and certification for which the scheme provides.

It appears, however, that there are many in the industry, particularly among the juniors, who, after all the explanation that has been given, find it troublesome to understand the details of the scheme, and their own place in it. In view of this, a simple summary has been prepared by Mr. Walter Hole, the Organizing Secretary, in which he has stripped the subject of all technicalities, and has put in plain language an outline of the scheme to serve as a guide to students who have not properly grasped its structural features and intentions. It will be seen from the article (published in later columns) that the scheme now caters for all grades of workers in the industry, from the craftsman up to the man who hopes to gain professional status. The first division deals with the training of gas-fitters; and this has been arranged in conjunction with the City and Guilds of London Institute. We want our gas-fitters to know not only the technics of gas-fitting and the utilization of gas, but also the elements of the sciences upon which those technics are based. Those who go through the course provided and prove in the end that they have absorbed the instruction they have received are the type of men the gas industry needs to-day; and they will be greatly sought after for responsible positions in the important work to be done on the district. Efficiency in gas-fitters means much to the consumers of gas and to the supply undertakings. Then there are those staff men who are engaged in the intermediary work of a gas undertaking—that is the work lying between that of the professional men and the craftsmen. No one who earns his living in the gas industry should be without knowledge of its processes and transactions, so as to be able to talk intelligently on them. There is a regular army of these men in the industry; but a very large proportion are ineffectives so far as the interests of the industry are concerned, other perhaps than in the routine clerical or other work upon which they are engaged from day to day. The inclusion of these in the scheme is a recognition of a latent value to which activity should be given. An increased intimacy with gas-works and gas-supply practices will be an intellectual advantage to them, will safeguard them against a display of ignorance and the pitfalls which surround those without exact knowledge; and, as men employed by a gas undertaking are expected by laymen to be in the position to give them information as to gas applications, their ability to do so will be an advantage to the undertaking. Such men will see from Mr. Hole's article what is provided for them, and how they may proceed. Even those who are isolated geographically, and so cannot attend classes, will find an open door.

Then full information is given in the article as to the professional courses in engineering and gas supply, each of which is divided into three grades—the Ordinary, the Higher, and the Diploma. A list is given of technical institutes where the courses can be taken, and from the Principals of which information can be procured. The list accentuates the fact that there are considerable areas in the country in which there is no proper provision for taking the courses. But these cases have been legislated for in the second part of the scheme, but in a manner which it is hoped will not be permanent in all cases. The necessary information regarding procedure in this connection is given by Mr. Hole towards the end of the article, which he concludes by dealing with the crown of the whole scheme—the Diploma.

A good piece of work has been done in meeting those conditions which opposed—in some respects it is believed only temporarily—the universal application of the scheme; and, after the explanations given elsewhere, the way to achievement should be found much easier by all students and intending candidates for those attestations of competence which will become important aids to securing preferment in the work of the industry.

The Gas Engineer in New Zealand.

THAT the man who undertakes the chief executive and advisory responsibility of a gas-works in New Zealand must be a veritable tower of strength and highly efficient is disclosed by the Presidential Address of Mr. James Lowe, M.Inst.C.E., the Manager and Engineer of the Auckland Gas Company, Ltd., to the Gas Institute of the Dominion. This is a new organization; and there can be no gainsaying that conference between the men of the gas profession in New Zealand is as essential as—perhaps more so than—it is at home or in other countries where organizations have long been established. If, in passing, we regard our conditions at home as the standard for comparison, then we find that, through their geographical situation, the conditions under which gas men in New Zealand have to work and meet difficulties go far beyond it. In contrast, circumstances at home—though we do not consider them light in comparison with the past—are easy;

and we know full well that the more conditions worsen difficulties, the greater the need for courage and technical ability to meet them. Mr. Lowe himself obtained much of his primary professional experience in a school where the gas man had to become thorough, and where he became hardened to difficulties, and met them full face. It was in the early days of this century when we were walking with Mr. Lowe in the gas-works at Glasgow. Thence he went to take the responsibility of the engineership and management at Auckland. He knows the value of professional conference and comradeship; and we wish the new Gas Institute of New Zealand a life of good and helpful work in the interests of the members and of the undertakings they serve.

The word picture which we published last week from the Presidential Address as to the conditions under which the gas industry is carried on in the Dominion, we are confident has given to gas engineers at home interest in their co.npeers working in the circumstances depicted; and to-day we reproduce a descriptive account from the same source of the works of the Auckland Company. Though these contain some special features in plant and process which will arrest the attention of gas engineers, we will here confine ourselves to a few comments upon the general conditions which confront the gas engineers of New Zealand, and which they meet with verve and success. It is obvious that there the engineer and manager has to be more self-reliant than the engineer at home. Here there are firms of spacious experience who specialize in various types of plant. Their experience is of inestimable value to the gas engineer, who, however, must have selective capabilities for his particular circumstances and the ability to discriminate and decide wisely on the representations and offers of competing firms. In New Zealand the engineer has to prepare his own plans, and frequently look after the fabrication and, almost invariably, the erection of his own plant. We pride ourselves nowadays in the workshops possessed by our larger gas-works. Mr. Lowe has had the opportunity, through a recent visit home, to make comparison of what is provided here in this respect with what, in the isolated circumstances of New Zealand, has to be furnished there. In consequence of the character of the work that has to be performed, through not being in the position to depend upon contractors for new structure and repairs, he tells us that the workshops on the gas-works in the Dominion have to be equipped with appliances and tools on a scale exceeding that to be found in similar sized works in Britain. One result of the war has been to increase self-reliance by engaging locally in the manufacture of certain forms of gas plant. That is a natural evolution in a distant country such as New Zealand with engineers strong in initiative and execution, and equal to meeting the needs—not only in days, but in years of emergency. There is another incentive to the people of the Dominion to be pioneers to the utmost in providing for their own needs, and that is capital costs, which are, through freightage, insurance, wharfage, &c., some 40 to 50 p.ct. more than at home. This is a further good reason for the exercise of engineering faculties with the view to lower initial costs, so long as efficiency is not assailed.

Again in the distribution department, conditions are not the same as here, though in one respect in this country we are getting a taste, through housing schemes and the construction of fewer houses on a given area of land, of what is a very common condition in New Zealand, save in certain of the principal streets. Mr. Lowe mentions that, owing to the practice of building houses of the detached type on sites usually not less than a quarter of an acre to each house, the density of population is less than in cities and towns at home. This, of course, contributes to higher capital and other costs for distribution, through less services being connected per mile of main with consequent smaller gas consumption per mile, though, naturally, from the health point of view, the open-space system of building has much to commend it. Then the chief meal of the day for all classes is taken in the evening; and therefore in the winter one has the peaks of the lighting, heating, and cookery loads all combining, between five and six o'clock, to make a peak of a formidable order. This also assists to swell the capital expenditure on mains per 1000 c.ft. of gas sold. But by superimposing a high-pressure system on the low-pressure network, considerable economies can be effected in the cost of mains in a growing district.

Considering these matters (and they do not sum up the conditions which, in comparison with this country, are adverse influences), there is no reason to be surprised that gas prices are higher in the Dominion than in Britain. Comparatively, we at home are in a highly favoured position in regard to coal. Unfortunately the most available coals in New Zealand are unsuitable for gas manufacture, owing to sulphur and non-coking characteristics. The result is that Auckland, in common with other gas undertakings, draws coal supplies from the Maitland coal-field of New South Wales, and from the West Coast mines of the South Island of New Zealand. Last year the cost of the coal was £2 2s. 9d., or £1 0s. 5d. more than in 1913; but the price of gas has not risen in the same proportion—being 7s. 6d. per 1000 c.ft., as against 4s. 3d. In this country we think we are badly treated by having to pay an income-tax of 4s. 6d., but in New Zealand it is 5s. 10d., and alone it represents 6·02d. per 1000 c.ft. of gas sold. The narrative of differences which are adverse to gas supply in the Dominion proceeds into unfair competition with Government subsidized electric schemes, towards the provision of money for which the gas undertakings and consumers have unfairly to subscribe as taxpayers. What happens is that the former have to compete with Power Boards supplied with electricity from State hydro-electric works, on which the Government are spending large sums; and are subsidizing them in various ways. The Power Boards do not pay income-tax or local rates, and deficits are made good from the general revenue of the State. We hope things will never go to that length in this country, but we are threatened with the application of part of the same policy. However, in New Zealand Power Boards also receive indirect subsidies through their plant coming in duty free, while gas and steam engines for other people are charged 10 p.ct. duty, and cast-iron pipes above 9-in. diameter and steel pipes above 6-in. diameter pay 20 p.ct. duty. In fairness Mr. Lowe mentions that machinery for any manufacturing purpose is now admitted free of duty, provided it can be shown to the satisfaction of the Minister of Customs that it could not have been economically manufactured in New Zealand. To cap all this, the Dominion possesses the most advanced labour legislation in the world. Agreements can only be made for three years, but invariably the term is two years. Thus labour ebullitions are constantly occurring; and consequently peaceful times for the gas manager are few and of short duration.

While after this gas engineers at home may think a little less hardly of their conditions, they will sympathize freely with their colleagues in New Zealand. It is curious that the Government there should employ their legislative power to pack upon the industrial burdens inseparable from geographical situation, other burdens which are neither just nor contributive to the best public service and interests.

Healthy Buxton.

Those scientists who delight in the measurement of the foreign particles which pollute and densify our atmosphere, and which are so luxuriantly contributed to it by the combustion of raw coal for domestic and industrial purposes in our cities and towns, have on occasion referred to the excellent condition in this respect of the air of Buxton, as compared with that of large industrial centres. But this tribute to the relative purity of the air of the town does not altogether satisfy the Mayor (Alderman C. W. Buckley), whose scientific attainments are well known in the medical world. He can write after his name M.D.(Lond.), and M.R.C.P.; and he is a distinguished consultant on rheumatism, gout, and allied diseases. He is also a University lecturer on balneology, of which subject he is a world-renowned authority. In addition, he is Director of the Biological and Bacteriological Research Laboratories of the Devonshire Hospital, of which he is also honorary physician. We mention these high qualifications to show that his opinions on domestic heating are not without the basis of good authority.

The Buxton Corporation Gas Undertaking (as a report in other columns shows) recently inaugurated new Gas Service Buildings—the title alone discloses their functions,

and attests the existence of a progressive administration. On the occasion, Dr. Buckley spoke of the utilization of gas as a heating agent. He acknowledged how considerably it has developed as a source of heat to the greatest possible benefit of the country, and yet his subsequent remarks indicate how large is the amount of work yet to be done in transferring domestic heating from the smoke-producing methods of our forefathers to the more scientific, cleanly, and labour-saving methods of modern times which have been promoted so extensively by the gas industry. Dr. Buckley is emphatic as to the value of gas as a heating agent. One of his remarks was that he is disposed to say there is no more efficient means of heating than by gas in the present day. It possesses great advantages over coal; and he sees in it the means of helping very largely in the solution of the smoke problem. While admitting that the smoke problem in Buxton is not a serious one, he regards it as quite serious enough; and he asked the people of Buxton to do all they can to eliminate smoke from the atmosphere of the town by using gas for both domestic heating and cooking. He would not have done this did he not believe in the virtues of gas heating. He also accentuated the facts that smoke in the atmosphere does much to prevent people enjoying the full health-giving benefits of sunlight, and that it means a serious waste of the valuable properties of coal. In his opinion, too, the gas fire possesses every advantage which can be claimed by the coal fire; it is not unhealthy, and does not contribute to the deterioration of the atmosphere.

One of Dr. Buckley's remarks suggests a comparison. He was referring to the value that is derived from the carbonizing of coal at the gas-works—mentioning among other points that 10 tons of coal will produce 130,000 c.ft. of gas, in addition to coke, tar, sulphate of ammonia, and the derivatives of tar. The gas supplied in Buxton, we believe, has a calorific value of 510 B.Th.U. per c.ft., so that the 130,000 c.ft. produced from the 10 tons of coal would give a potential thermal value of 66,300,000 B.Th.U. Used in gas-fires, of this quantity some 75 p.ct. would be given to the rooms as useful heat, or 49,725,000 B.Th.U. Some people have the idea that on the basis of heat rendered there is a considerable difference between coal and gas in favour of the former. This notion the gas industry must combat, seeing that the difference resides more in imagination than in actual fact. For instance, assuming the 10 tons of coal were used in domestic fire-grates for room heating, only about 20 p.ct. of the potential heat value of the coal would be given as useful heat; the remainder passing away up the chimney. If the coal has a potential thermal value of 29,000,000 B.Th.U. per ton, the value of the 10 tons would be 290,000,000 B.Th.U.; and 20 p.ct. of this would be 58,000,000 B.Th.U., as against the 49,725,000 B.Th.U. which would be given by the combustion of the gas for the same purpose. Thus we see how narrow becomes the difference; and, from the economy point of view, it is reduced still further by the fact that gas-fires can be lighted and extinguished as needed, while in the case of the coal fire waste of fuel is inevitable through the maintenance of the fire in the time between the stages of actual requirement. Further compensation is given by the labour-saving and convenience of a means of heating which can be used at will; and, moreover, a means which cannot be charged with assisting to produce the miasmic conditions of the atmosphere of which so much complaint is made on account of the injury to health and property. Such testimony as Dr. Buckley gave at the opening of the new Gas Service Buildings for Buxton is invaluable.

The hope of the Mayor that the people of Buxton will turn still more extensively to a fuel supplied to them through pipes and always on tap is likely to be fulfilled, and at a brisker rate than ever before. The new Gas Service Buildings are a means to that end. It is one of the most advanced provisions that has been made for increasing efficiency in the district work of the undertaking; and the district work is the very genesis of gas development. We congratulate the Chairman (Alderman A. W. Wall) and members of the Gas Committee upon their enterprise, and the Engineer and Manager (Mr. F. G. Shaw), whose work for the concern has won for him the complete regard of the Council and of the ratepayers. Another matter for hearty felicitation is the financial condition of the concern. It shows administrative wisdom; and, in these times of high costs, it will be of considerable advantage to the town through the contribution the gas undertaking will make to public service, which should be the predominant feature and aim of any productive concern municipally controlled, and not the making of profits to aid the rates. Many a local authority gas concern may well envy the Buxton undertaking its low balance of unliquidated capital. The capital of £90,000 has been wiped-out with the exception of £7000, and this could have disappeared had not £18,000 been contributed since 1911 to the relief of the rates, and a subscription of £2000 made to the cost of erecting the Town Hall. The expenditure on the new Service Buildings—some £3000—has also been defrayed out of revenue. Happy should be all associated with the Buxton Gas Undertaking.

British Empire Gas Exhibit.

At 10 a.m. on Saturday, May 9, the gates of the British Empire Exhibition will be re-opened to the public. The ceremony is due to begin at 11 a.m.; and the programme is now awaiting the approval of the King. Semi-state, it is expected, will be the order of the day. The arrangements for the Gas Industry's Exhibit are proceeding splendidly. An entirely new show has been devised; and additional adjoining space has been taken. A special feature of the exhibit will be a display, with an Imperial keynote, showing that gas is already freely used, and is fast making headway, for industrial no less than for domestic purposes, not only in Great Britain but throughout the go-ahead Dominions and Colonies. Important industrial uses of gas and coke will be demonstrated on a comprehensive scale, while in the large and artistic Rest Lounge the solution of the housewife's troubles by the use of gas on modern labour-saving lines will be the main attraction. In addition, part of the new space taken will be turned into a hall where demonstrations on the cookery of Empire foods, preceded by short lectures, will be given several times a day.

Coke Competition.

Candidates are reminded that June 30 is the latest date for receiving papers. Full details were published in the "Journal" for Feb. 18. Any additional information required can, by specifically stating its nature, be obtained from the Editor of the "Journal." The prizes range from £200 down to £10—the total sum for distribution (through the kindness of the Woodall-Duckham Company) being £1000. The honour of being the author of a winning paper will also count for much.

Cost of Free Maintenance.

In last week's issue, editorial comment was made upon the statement of Mr. J. W. M'Lusky at the North British Association meeting, as to the cost of free inspection, adjustment, and maintenance of consumers' fittings, less outlay for materials. The figure works out to 0·592d. per 1000 c.ft. sold. From the report of the discussion on the papers by Messrs. Napier and Keillor, and the statement of Mr. M'Lusky (published last week), it is seen that smaller towns are finding that the cost is in close proximity to that of Glasgow. Mr. R. Sturrock, of Ardrossan, states that eighteen months' experience there shows that the cost works out to 0·52d.; and Mr. J. J. Scott, of Cowdenbeath, says in his case—a mining district—the cost does not exceed ¾d. per 1000 c.ft. Mr. M'Lusky also supplied, in replying to the discussion, some further information as to the staff employed on the work, which gives additional value to the particulars as to houses and appliances which appeared in the "Journal" last week.

Blow Gases for Retort Heating.

Mr. James Lowe, the Engineer and Manager of the Auckland (N.Z.) Gas Company, as our readers are well aware, has taken a great interest in the development of water-gas plants. At his works, there are three such plants in continuous use—two of them being installed in conjunction with the horizontal retort-house, and one for the vertical retort installation. An interesting feature is that the blow gases are utilized for heating

the coal-gas retorts. In the case of the plants used with the horizontal settings, the water gas, after being partially cooled, is passed directly into the foul main; but in the third case the hot water gas is passed through the coal charges in the vertical retorts. Thus in both gas processes a higher thermal efficiency is promoted.

Price Increases.

"Meteor" of the "Electrical Times" is cynical regarding the increases of the price of gas which are taking place, owing to the state of the secondary products markets. While this condition obtains in the gas industry, he says reductions in the price of electrical energy are being announced all over the country. Not long since, the electrical papers were crying out against the maintenance of charges for electrical energy which they considered were delaying the arrival of universal domestic electrification. However, "Meteor" says: "It should not matter very much to the gas people that their commodity is growing dearer whilst ours is becoming cheaper; for Mr. Goodenough has recently demonstrated that there is such an enormous gulf between one pennyworth of gas and one pennyworth of electricity that we can only look forward to a continuation of our miserable existence." Mr. Goodenough said nothing about a "miserable existence." What he remarked about the gulf between a pennyworth of gas and a pennyworth of electricity for heating purposes is not altered by the cheap sneers of "Meteor."

Wages Subsidy and Employment.

Various investigations are being made in connection with the proposals that a wages subsidy should be provided in the case of the more important industries to bring about an increase in the amount of available employment. In addition to the Government Committee, who are exploring the whole question of subsidies, and a Sub-Committee appointed by the Executive of the Parliamentary Labour-Socialist party, the Federation of British Industries are also moving in the matter. They have appointed an exceptionally strong Committee to inquire into the proposals for alternative methods of relieving unemployment by devoting moneys at present expended on the dole to the purpose of subsidizing industry and thereby enabling crease in the amount of available employment. In addition to pointment of the Committee, however, is not to be taken as an indication that the Federation endorse the proposal. Indeed, the matter is one of such extreme complexity, and raises issues of such importance, that it is impossible for industry to express any views either one way or the other until the question has been subjected to expert examination, and research made into every aspect. As an outcome of the Committee's labours, the Federation may be in a position to submit recommendations to the Government, always assuming that, after full investigation, industrial opinion is favourable to the scheme.

The Coal Inquiry.

It is difficult to say whether or not any good is likely to come out of the joint inquiry by the representatives of the coal-owners and the Miners' Federation into the conditions of the mining industry with the view of ascertaining what remedies shall be applied. Those upon whose word there could be reliance are not divulging anything; but Mr. A. J. Cook, the Secretary of the Miners' Federation, appears to find it impossible to keep his tongue from wagging, and referring in depreciatory terms to what the Joint Committee are doing. In his opinion the efforts of the Committee represent so much time wasted. He also states that the owners have been pressed for suggestions for improvement, but they have not put any forward. Mr. Cook seems entirely to misunderstand the objects of the exploration that is being made, although he is a member of the Committee. The first thing for the Committee to do is to ascertain and investigate the causes of the present conditions of the industry, and then, when they have done that, to suggest, jointly if possible, the remedies which in their wisdom they consider should be applied. At the same time, Mr. Cook declares that the men are not going to work longer hours, and intend to have a living wage. But if he would sit down quietly for a little time and consider where the money is to come from for an advance of wages for the work performed, he would show a prudence which has been absent from his wild talk—at any rate during the past two or three months. Perhaps if the Joint Committee persevere, they may come to a conclusion which will show how more money can be made, and at the same time increase the demand for British coal in face of foreign competition. Maybe it will be found that the only way of enlarging the revenue from coal is the very one which the Federation and Mr. Cook say they will not tolerate. If it is the only way, and the miners will not apply it, then there is nothing more to be done, but to let things drift on as they are doing now, and so become worse. But Mr. Cook has another plan—the plan of force, which would not provide, but would waste, money. He tells all whom it may concern that the Miners' Federation are going ahead with their arrangements for an alliance with other unions to meet "eventualities." The eventuality he has in mind is no doubt the securing for the miners money which does not exist. Another point is that, although the inquiry is proceeding into the economic conditions of the industry, the various districts are now considering the framing of a new wage programme which is to be discussed at the next delegate conference, when the question of amending or giving notice to end the present wage agreement is to be decided—from the point of view of the miners.

PERSONAL.

Mr. Frank Harding Jones, M.Inst.C.E., who has for many years been a Director of the Wandsworth, Wimbledon, and Epsom District Gas Company, has been elected Chairman of the Company, in succession to his father, the late Mr. H. E. Jones. In making the announcement, the "Wandgas Magazine" adds that "his election secures unbroken the continuity of great and generous services of the Jones family to the Company."

Mr. E. L. Farquhar, of Lower Largo, has resigned the position of Hon. Secretary and Treasurer of the Eastern District of the Scottish Junior Gas Association, and will be succeeded by Mr. John Scobie, of Dunfermline.

The new President of the Chichester Rotary Club is Mr. T. N. Ritson, the Engineer and Manager to the City of Chichester Gas Company. Mr. Ritson, who has taken a great interest in the Rotary movement since the Club was started in 1919, has addressed the members on "Gas and the Bye-Products in relation to the War," and "The Origin and History of Coal;" and he was to have lectured on "Water Supply" last month, but was unfortunately indisposed, so that this had to be postponed.

On the occasion of his marriage, which took place on the 9th inst., Mr. Lawrence Farquhar, Gas Manager at Peebles, was presented by the members of the Town Council and burgh officials with a sum of money with which to purchase a tea service. Provost Davidson, who made the presentation at a meeting of the Gas Commissioners, said Mr. Farquhar had endeared himself to them all by his amiable and quiet ways, and they asked his acceptance of the gift as an expression of their regard.

OBITUARY.

We regret to report the death of Mr. William Bryant, of "Cardynham," Truro. The deceased, whose wife had died only a few weeks previously, had been Chairman of the Padstow Gas Company, Ltd., since its formation, and was a Director of several other gas undertakings in Cornwall, including the Camborne Gas Company. He was a well-known figure in the district, and great sympathy will be felt with his relatives.

Mr. J. Readshaw, who for fifteen years has been one of the London Representatives for the Volker Lighting Corporation, and for Lighting Trades, Ltd., since its formation, died on the 11th inst., at his home at Colliers Wood. The funeral took place on Saturday last in West Norwood Cemetery.

Institution of Lighting Engineers.—In the matter of the payment by local authorities of the expenses of delegates in attending the annual meeting and conference of the Institution in Leeds next September, the Hon. Secretary (Mr. W. J. Liberty) has been officially informed that the Minister of Health "would be prepared to consider applications from local authorities whose accounts are subject to Government audit for sanction to the payment of the expenses of attendance at the meeting and conference of not more than two delegates, one of whom should be the engineer or superintendent for public lighting in the district."

ELECTRICITY SUPPLY MEMORANDA.

Illuminations at Wembley.

Last year there were two sets of opinions regarding the lighting of the British Empire Exhibition grounds. Those who harbour the idea that everything electrical must be good, and who so deceive themselves, considered that the electric lighting was exquisite, and poked fun at the gas lighting in the Amusements Park. But the major electrical opinion was that the gas lighting was excellent, and that electricity had lost one of the finest opportunities it had ever been given to display its capabilities in subscribing to public entertainment by lighting effects. This year in the main parts of the grounds, an attempt is going to be made to do much better in effective illumination. The "Illuminating Engineer" informs its readers that Messrs. Sparks & Partners, the Consulting Engineers, invited the Electric Lamp Manufacturers' Association to put forward proposals; and their Lighting Service Bureau submitted a scheme which has been accepted. But so far as we can gather, there is nothing very original in what is to be done, excepting in respect of a zoological, piscatorial, and horticultural collection of models with (apparently) coloured lamps in their vacuous insides. Some of the principal buildings, entrances, and garden beds will be outlined with electric lamps of selected colours. In the north gardens and at the south-west entrance will be installed two illuminated columns of neon tubes, some 40 ft. high, having the appearance of columns of fire. In "Kingsway," our contemporary says, sixty tall standards are being erected, each fitted with twenty yellow-sprayed 100-watt gasfilled lamps. To provide contrast, and to throw into relief the colonnades of the Palaces of Engineering and Industry, flood-light projectors of a special type will be concealed behind the columns. The lower projectors will be fitted with light blue screens and 1000-watt lamps; the light being thrown upwards. The upper projectors will serve for the downward projection of light of a rose-pink colour. On the roofs steam-jets illuminated by a flood-light projector and colour-screen will resemble dancing coloured flames. The buildings will be outlined with 20-watt yellow-sprayed lamps on 18-in. centres; the panels being treated with green lamps, and the bases of flag-poles with red. There will be the illuminated swans, ducks, Noah's Arks, water lilies, and grotesque fish floating in the lake. Near Digger's Bridge a family of illuminated penguins is being installed; on the lawns and on the southern side of the lake, illuminated frogs, snails, tortoises, rabbits, and hares will be seen. Some of the trees will be alive with flocks of brilliantly lighted and gaily coloured parrots and owls. We are glad they will be of the dumb kind. One spreading oak will be the centre of a miniature "Garden of Eden," and will bear large luminous apples; and entwined round the trunk will be a forbidding serpent studded with green lamps. Oak trees are not supposed to bear the kind of apples of scriptural fame. The trees on the tea or dancing island will be fitted with large oranges and lemons containing 60-watt lamps. The frontage of the Stadium will be flooded with amber light from concealed projectors, and the colonnades will be thrown into relief by concealed lighting of a contrasting colour. On the roof will be a mammoth fan of coloured searchlight beams. We shall be interested to see how it all works out.

Scientific Two-Part Tariffs.

The search for a suitable tariff for the electricity supply industry promises to be an eternal one. The men of the industry have been largely concentrating for some years past on a two-part tariff, but hitherto they have not succeeded in finding one which could glory in the fact that it is founded upon the electrical requirements of the consumers and the electrical costs of meeting their demands. Basing the fixed charge upon rateable value, floor area, or the dimensions of the buttons of the waistcoat of the householder, has no justification, and inflicts upon different individuals divergent treatment which cannot be in any way vindicated. These considerations are well known to the men of the electrical industry; and, to the credit of some of them be it said, they are endeavouring to find means to construct a bi-part tariff which shall have scientific authority. So far, there has not been success. As a matter of fact, the farther they go with their proposals, the more complex the conditions become, and the less explicable to the consumers. It appears that the only possible method to adopt will be to base in some way the fixed charge upon electrical requirements, without taking into consideration the whole of the embroidery which some of the investigators would like to apply to them. These remarks are suggested by perusing two papers which were recently read at a meeting of the Institution of Electrical Engineers. One of them was by Mr. H. M. Sayers; and in this he discussed the influences of load factor, diversity factor, and distribution costs and losses upon the construction of a tariff. The other paper was jointly by Mr. G. Wilkinson and Mr. R. M'Court, in which they sought, by "simplification and discrimination," to frame a system which in their opinion could be applied. But the so-called simplification and discrimination there can be no question would lead to still greater confusion in the minds of consumers, and might possibly be obstructive to the greater use of electrical energy which they desire to promote.

Distribution Influences.

The contribution by Mr. Sayers is of extreme interest, as it shows how largely distribution costs should affect the charges to the consumers in particular localities. The author submits that a practical tariff should be based upon costs. This, of course, is a matter of comparative simplicity when applied to factories, traction, and bulk supplies; the only consideration in the upper direction being the cost at which large consumers can generate for themselves, with (say) gas-driven plant. The real difficulty is the case of the domestic consumer. In the domestic business, individual costs of services, meters, and working expenses are relatively high, and dissimilar as between one consumer and another; this being partly due to the differences of their load characteristics. Lighting is at the present time the main demand in electrical domestic service, and the load factor is of the order of 10 to 12 p.ct. If the load factor could be raised from 10 to 30 p.ct., Mr. Sayers says this would reduce the cost of the units sold by at least one-third all round, and probably more. While the influence of load factor on generating costs has been extensively studied, the effect on distributing costs has not been scrutinized so closely. This is no doubt due to the complexity of the subject, and to a disinclination to enter into it in detail. It is pointed out that distribution costs per unit sold are often two to four times the cost of generation. Thus the scope for research into distribution costs is large. An interesting point is made by Mr. Sayers when he says that the diversity factor only improves the load factor on the distribution side if the diverse loads are supplied through the same mains; but the cost of distribution through any one feeder with a 10 p.ct. load factor is not in the least reduced by the existence of other sections enjoying a 50 p.ct. load factor. This is a point which is not always kept in view by electrical men when they are considering somewhat expensive extensions of their distribution systems into rural areas, where the load factor is not likely to be good or the diversity factor of much consequence. In several ways, the author shows that the relations between cost per unit sold, load factor, and form factor, are not alike for generation and distribution; the latter being more complex and more affected by load characteristics. Another useful point to remember is that generation costs when based on "per unit sold" include distribution losses; but, on the other hand, the cost per unit sold, in view of the fact that it includes these losses, is not fair to the station in determining its economy *per se* and the efficiency of its running. In order that means may be taken to reduce distribution costs, one must, of course, obtain information as to their magnitude. This is obvious when one remembers that there are systems where the units sold only reach some 55 to 60 p.ct. of the total sent out.

The Tariff Suggested.

The costs of the units sold through any distributor in a year are: (*a*) The cost of the total number of units delivered to the distributor, including all capital charges and the cost of the losses up to the feeding-point. (*b*) The capital charges to the distributor. (*c*) The capital charges on the services, meters, &c., and the cost of meter-reading, &c., for all consumers. With reference to item "*c*," this should be charged to the individual consumers as a meter-rental, or a charge per KW. of connected load. The total of "*a*" and "*b*" divided by the total units sold gives a sum per unit which, with a reasonable addition for profit, is a proper average price for all the consumers. The method which the author suggests for arriving at tariffs for domestic supply is to classify consumers by their load and diversity factors—that is, by observation of selected groups with similar proportions of connected load for different uses. He holds that tariffs recognizing the load and diversity factors of domestic consumers by classes are practicable, and will attract the most desirable domestic load—thus improving the utilization of distribution systems and bringing about progressively a reduction in the charges to consumers.

A Second Scheme, and a Fine for Excess.

Turning now to the contribution of Messrs. Wilkinson and M'Court, they agree that a two-part tariff is the best for encouraging the greater use of electricity; but they contend that the charge should be based on the electrical requirement of the consumer in watts or kilowatts. Their idea is that the requirements should be classified on a basis upon which the consumer would pay 8d. per KW.H. for a minimum number of units, and a low price per KW.H. for the residue up to a declared maximum. For any excess the user would be fined by charging him at 6d. per unit. Thus we have once more proposed simplification running into complexity. From this state of things our electrical friends seem to find it impossible to escape. It is suggested that for such a tariff a cheap and reliable mechanism is required, which, while limiting the consumer to his declared maximum supply, will also secure a higher rate of tariff during the time when he exceeds, by accident or design, his declared maximum demand. This, we

take it, would mean additional initial costs in fitting out the consumers. The authors believe they have devised a suitable device for the purpose. They use a two-rate meter, on one of the dials of which all current used under normal conditions, including the number of units at 8d. per KW.H., is recorded. After this, the low price per unit comes into operation. Then, if the consumer exceeds his pre-arranged demand, a "discriminator" comes into action, and automatically transfers the record of current consumed to a second dial—the units registered by this being charged at (say) the 6d. rate. We are not surprised that in the discussion there was a good deal of criticism of this proposal. One of the speakers suggested that what was called for was a means not of preventing excess units being consumed, but of preventing their being used when the system is fully loaded. It would, however, be an insuperable difficulty to obtain a mechanism which would discriminate in the case of individual consumers, when using excess units, as to whether or not the system was fully loaded. From the various speakers, the authors did not get much encouragement, though their efforts to design a two-part tariff with scientific authority were looked upon as a good contribution to a vexed question.

"Safety" Items.

The electrical papers a time ago hammered at the question of the removal of gas from the service of lighting trains, on the ground that the fires following accidents were due to its presence. Fires were, of course, experienced in train disasters in the days of the old oil-lamp. Our friends were also heedless of the fact that, if a cylinder is fractured containing gas under pressure, the gas does not linger about for the purpose of providing the electrical journals with a point against the rival. The "Lest We Forget" articles of our dear old contemporary the "Electrical Review" are well in memory. We are not going to imitate it, by now pleading that it is time electricity was abolished for use by or on trains because of the fearful results of a collision between two electric trains in the suburb of Las Planas, near Barcelona. Though gas was not used on those trains, the carriages of one caught fire after leaving the rails. What has the "Review" to say to that? The train which left the rails carried about 180 passengers; and the messages from Barcelona state that something like thirty lost their lives, and approximately 105 were injured—fifty, it is feared, fatally. Many of the bodies were terribly mutilated, some were crushed beyond recognition, and others were burned when the train caught fire. We will not ponder over the ghastly details. Will the "Review" in the circumstances? Returning home, we see that the evening services at the Burton-on-Trent churches were brought to an abrupt conclusion on Easter Sunday, owing to a breakdown at the Corporation electricity works. Not only the churches, but other people who had put their faith in the fickle illuminant suffered the penalty of untimely inconvenience. Last Friday week at the Wellington Mills at Port Dundas, Glasgow, there was an explosion of some highly inflammable vapour employed in the waterproofing process carried on at the works. One young woman was killed, and two others were seriously injured. It is conjectured that the ignition of the vapour was caused by a spark from a machine, or by the fusing of an electric light wire. The reporter who made this statement ought to be handed over to be dealt with by the electrical editors in London. There is nothing that makes them so cross and sets them capering so much as the suggestion that electricity is guilty of such conduct.

Water Power and Electricity.

During and since the World Power Conference, we have heard a great deal about the cheapness of electricity in countries possessing large water powers; and interesting tales have been told as to the considerable and varied use that is made of the low-priced current. The communities are fortunate in the possession of water power so long as it behaves itself, in view of the fact that countries like Norway, Sweden, and Switzerland are largely dependent upon imported coal. But, as we pointed out some time since, those countries with their water-power generated electricity have their difficulties, and occasions when supply cannot possibly satisfy the demand. There come periods of drought when there is incapacity to meet the large loads put upon the plant at times of luxuriant provision by Nature of water power. We find from a report published in London as recently as April 6 that in Switzerland, in certain districts and in many towns, electricity is still being rationed owing to the continuation of drought all over the country. It is a pity we cannot transfer some of our superfluous rainy weather to the drought-oppressed people of Switzerland. For some six months they have had a drought; and it is causing all sorts of difficulties through the country—among them being this one of the provision of electricity. The only means for avoiding insufficiency of water power during periods of drought for the supply of electricity is to provide large steam-raising plants as standbys to the water power; and the larger the use made of the water-power generated current, the greater must be the aggregate of the steam-raising units. This means a considerable expenditure of capital, which must be a charge at all times upon the consumers of the water-power generated electricity.

LOW-TEMPERATURE DISTILLATION.*

"Low-Temperature Distillation," by Sydney H. North (late Editor-in-Chief, "Oil Engineering and Finance") and J. B. Garbe (late Assistant Professor at the University of Louvain), is, above all, well written. When the authors deal with what may be termed the "straight" technical matter, they are sound enough; but when they beat the big drum of low-temperature carbonization—and this is done at intervals far too frequent throughout the book—they are too sweeping in their conclusions, and too apt to be carried away by their own viewpoint. No thinking man will deny the desirability of obtaining a home-produced oil supply; and if this can be done by distilling what is now regarded as waste fuel, a great industrial need will be filled. But when the authors go on to say glibly that, "for ordinary industrial fuel . . . and for domestic purposes of every form, the future lies in passing all the bituminous coal through low-temperature carbonization, extracting the maximum of oil possible of the highest quality, and forming ultimately a synthetic coal, smokeless and adapted in composition and form to the purpose for which it is destined," the man with a broad scientific outlook will not be greatly impressed by this dogmatic statement and many other similar ones; nor will he agree that "the experimental period of low-temperature treatment is past."

The first chapter takes the form of an introduction to the subject; and the authors say that the great mistake which has been made by the majority of those who have turned their attention to the invention of a process whereby the bye-products from coal could be obtained has been that they have set out with the idea of securing as great a variety of products from the coal as possible, instead of directing their energies into one definite line. The object which should be kept right in the forefront, they state, is that of producing the largest quantity of oil, and using whatever residual fuel is obtained for briquette manufacture, combining this with waste bituminous coal. The next chapter is devoted to early experiments in the destructive distillation of coal; and it is put forward that "in carbonizing coal for gas-making purposes and in heating it for the production of coke, what are to-day very valuable products are lost." We would remark here that, if in exchange for a shilling piece twelve coppers were received, the shilling would not be lost; and the mere fact that the authors of "Low-Temperature Distillation" prefer their shilling to be replaced by a sixpence and two coppers is no argument in favour of their plan. According to Messrs. North & Garbe, carbonization of coal is carried out for two chief purposes—one for the manufacture of illuminating or power gas, the other for the production of coke. "Illuminating gas," in view of the enormous and ever-extending use of gas for heating, is to-day a meaningless term.

Three chapters are devoted to descriptions of modern low-temperature plant and special points in modern practice; and others deal with the subjects of peat, lignite, oil shales, briquetting plant, treatment of the residue from distillation, and the materials available in Great Britain. Throughout the book considerable importance is attached to the need for carbonizing at really low temperatures, and stress is laid on the utilization of superheated steam as a distilling medium. In discussing the experiments which have been carried out by the Fuel Research Board, the authors suggest that the temperatures generally employed at the Board's station are not those from which the best results, as far as quantity and quality of the oil are concerned, may be obtained. Speaking of the tests made in connection with a South Wales gas coal, they say that "admirably as the work was done, and interesting as are the results, they do not add anything to our previous knowledge. The temperature employed was so high that the principal product was gas, with the result that the yield of oil was small. . . . It is curious that the Board, in view of the great need of this country for an oil supply, do not devote some attention to the temperatures at which this could be secured."

"Low-Temperature Distillation" is—as we have already mentioned—exceedingly well written; and it will be read with interest, profit, and enjoyment. If all do not fall in line with the opinions it expresses, at least it does put forward opinions—and this in itself is of the utmost value. An appendix to the book, in addition to a consideration of the production of oil from coal, anthracite, lignite, peat, &c., by "hydrogenation," contains many useful tables and results of tests.

* "Low-Temperature Distillation," by S. H. North and J. B. Garbe. Sir Isaac Pitman & Sons, Ltd. Price 15s. net.

Gas in Dental Surgeries and Clinics.—The current issue (No. 133) of "A Thousand-and-One Uses for Gas" shows the important part which heat plays in the various processes involved in the manufacture of dentures. It gives an interesting "peep behind the scenes" into the dental mechanics' workshop, and proves that, in almost every stage of the modelling and finishing of dentures, gas is required. The issue, with its numerous excellent illustrations, will be of interest to dental surgeons and others professionally engaged in this work.

ELECTRICITY SUBSIDIZING.

The Case of Great Yarmouth.

THE idea that the Unemployment Grants Committee will, to help to relieve the workless, subsidize electrical schemes, no matter their nature, by paying over a long term of years 50 per cent. of the interest on the money expended, has tempted many electrical engineers to evolve projects and estimates. Some of these are vague, inconclusive, and absurd; and we think there will be a good deal of disillusionment and disappointment before the end is reached. If we are wrong in this, and those who have to deal with such schemes on behalf of the Government allow conditions such as have been assumed, for example, in the case of Great Yarmouth by the Corporation Electrical Engineer (Mr. P. G. Campling), in making estimates for a scheme involving an expenditure of close upon £200,000, then there would be good cause for a general revolt against this sort of thing on the part of the taxpayers, and especially those large ones who are in business competition with electricity supply concerns. It is not the duty of the Government to render financial aid to one industry to the detriment of another engaged in equally important public service.

In this article we intend to examine the estimates for the Great Yarmouth project; and we should like an answer to two questions: Have the Electricity Commissioners approved of the Great Yarmouth scheme? If so, have they agreed to the terms adopted by the Electrical Engineer for the repayment of the loans required for carrying-out the scheme—terms of years in some cases which are opposed to the practice of the Commissioners? We should not be surprised to learn that they have approved of the scheme from the technical point of view; we should be astonished to find that they have granted the whole of the periods of repayment upon which Mr. Campling has budgeted, and upon which periods the whole financial structure and outcome of the scheme rests. Then, assuming the Electricity Commissioners have concurred in the repayment periods (to which further attention will be directed presently), will the Unemployment Grants Committee pledge the Government to pay for fifteen years half of the interest involved by the proposed outlay, some of which it is intended to spread over the next three or four years?

OPPORTUNISM—RELATION OF THE SCHEME TO UNEMPLOYMENT.

Before dealing with the financial aspects, there are one or two general observations we should like to make. Unemployment grants, we were under the impression, were intended for the specific purpose of giving work to the unemployed; but in this £200,000 scheme for Great Yarmouth, the specific purpose of the expenditure is not for the relief of unemployment, but to bring an effete electricity supply system up to approved modern standards. Such expenditure is entirely a matter for the undertaking itself; but the report of the Electrical Engineer, with its assumptions as to long-period repayments and a generously-disposed Government in the matter of grants, distinctly discloses an idea that the opportunity is a good one for setting the Great Yarmouth electrical house and system in order by the useful aid of national funds. It is clear that those who are looking after the electricity supply of Great Yarmouth are opportunists of the first water. But is this fair to other industries who are large taxpayers, and especially to the industry with which electricity is in keen competition?

There is another general point. It is that, as already said, the unemployment grants or subsidies were intended to assist employment in industries which are suffering seriously from lack of work; but we are not aware that this is the state of things in the electricity industry, or the part of it supplying plant. Thus any money the nation has to spare for subsidizing work should be directed to the most needy quarters. The heaviest part of this Great Yarmouth scheme proposes that the entire transmission, transforming, and distribution system should be converted to three-phase 50 cycle, which necessitates also rewinding and wiring motors, and changing meters and lamps, and involves an expenditure of £130,679, out of the total proposed outlay of £194,476. The whole of this work, it seems, would have to be done anyway to modernize the system, and fit it for the work it has to do; and therefore the scheme would have to be carried out whether or not subsidies are allowed. We cannot see the slightest justification for the Unemployment Grants Committee allowing any subsidy in the way of interest for any term or terms of years for any part of this work; if an exception is made for a single part, it should be restricted to the cost of the unskilled labour employed in the laying of the cables.

THE SCHEME.

To enable readers properly to appreciate the position, it should be mentioned that the present supply of electricity in Yarmouth is of the earliest character known as the single-phase system; and the Electricity Commissioners have refused to sanction further loans for extensions to this obsolete system. The Corporation have therefore resolved to change it from single phase to three-phase alternating current. Hence the report of the Electrical Engineer, recommending a scheme (including a new generator, converter, and boiler plant), and involving a total estimated cost of £194,476. The Electricity Committee and the Council have accepted the report; and there seems to be an understanding among the members of the latter that the Electricity Commissioners have also approved the scheme. From an engineering and technical point of view, that may be so; but we cannot think the Commissoners have had before them the financial side of the proposals as submitted by the Electrical Engineer, or, if they have, we cannot believe they have given their approval to it.

UNCERTAIN, BUT WORTH THE ATTEMPT.

Dealing with the financial weaknesses of the scheme, we cannot do better than begin by quoting the following passages from the report of the Electrical Engineer:

> From information obtained, the Unemployment Grants Committee are likely to assist in this scheme to the extent of 50 p.ct. of the interest for a period of fifteen years, *in view of which I should attempt to get sanction for the whole scheme.*
>
> By adopting the entire scheme, you are making provision for the future, modernizing your power station and distribution systems, by which increased revenue may be earned, and the outlay will effect savings equivalent to £12,500 per annum. Against this we have . . . estimated loan charges which show that it is possible to do all this modernizing and be approximately £2000 to the good.

There are two or three striking points about the foregoing extract. The first is the uncertainty as to what the Unemployment Grants Committee will do. They "are *likely* to assist in this scheme to the extent of 50 p.ct. of the interest for a period of fifteen years." A more likely thing is that they will not do anything of the kind when they learn of the opportunism underlying this project, as revealed by the naive statement: "In view of which [that is, what the Grants Committee are 'likely' to do] I should *attempt* to get sanction for the whole scheme." The suggestion of an "attempt" indicates an uncertainty in the mind of Mr. Campling as to whether there will be success in this. The "likely" assistance shows the frailty of the foundation upon which the financial structure of the scheme (as given in the report) rests—a scheme which, in every particular, should have its costs charged against the undertaking itself, and not be subsidized from any external source. We are afraid that—deducting the hoped-for savings from the charges based upon long repayment periods and the scooping-in from national funds of 50 p.ct. of the interest for fifteen years—the "£2000 to the good" is an aspiration for the fulfilment of which the chances are very slight. The Electrical Engineer finds the scheme will effect savings of £12,500, and the total of the interest and sinking fund charges will be £15,408, showing an annual deficit on the working of £2908. But if the Unemployment Grants Committee allows a grant of 50 p.ct. of the interest (which amounts to £9679), this would give £4840, from which the deficit of £2908 could be deducted—thus showing a profit per annum of £1932, or (say) £2000. That is really humorous. We were unaware that the Unemployment Grants Committee were appointed to help to put profits into the pockets of electricity undertakings. Of course, the estimated advantage all depends on the repayment periods allocated to the loans by the sanguine Electrical Engineer and the generosity of the Grants Committee.

LOAN PERIODS.

Next let us consider the loan periods—optimistically hoped-for and probable! The Electrical Engineer of Great Yarmouth has a good opinion of plant longevity, and of the "capital" value of replacements of appliances in the possession of consumers. There is little doubt he has gone far beyond what is probable in this matter. For a new steam pipe system, he has assumed a 25-year repayment period; 15 to 20 years is likely to represent the maximum allowed by the Electricity Commissioners. While he takes 30 years for a water-circulating system, the maximum usually allowed by the Commissioners is 15 to 20 years. The estimate of 15 years for a generator and 20 years for a converter will no doubt be realized. But 25 years for boiler plant may have a maximum of 20 years applied to it. The Electrical Engineer is probably right with 25 years in respect of cabling and sub-stations; but to take 25 years for rewinding and wiring motors and changing meters and lamps is absurd. The maximum is 3 to 5 years. These three items—rewinding motors and changing meters and lamps—it is calculated, will represent an outlay of £23,104. This amount of expenditure is merely to substitute something at present existing, and is to all intents and purposes a gift to the consumers; there is no capital value represented by the outlay either to the undertaking or the consumers. Therefore, is it likely the Electricity Commissioners will allow a repayment period of 25 years for these items? Is there any definite knowledge that maxima repayment periods based upon precedents will be allowed by the Commissioners in respect of all the other items of expenditure? About the Engineer's estimates, indefiniteness is, in our opinion, a prominent feature. His computed profit, too (which has no doubt caused some of the councillors to thank heaven for a highly considerate Government with a charming preference for things electrical), is further built on the mere hypothesis that the Unemployment Grants Committee will make a

grant of 50 p.ct. of the interest for fifteen years. As already indicated, we fail to see how the Committee can make a grant of interest on capital for such things as changing consumers' meters and lamps and rewinding motors.

Supposing There is No Grant.

There is thus something beautifully problematical about the repayment periods and the extent of the grant of interest. However, for the sake of argument, allowing for a grant of 50 p.ct. of interest in all cases, and adjusting loans to the maximum periods, we find that a total of £14,613 would be required to meet loan charges and interest. Deducting from this the estimated savings of £12,500, instead of a profit of £2000, we arrive at a deficit of £2113. Supposing the grant of £4840 towards interest is not obtained, the annual total required to meet loan charges and interest would be £19,453, which would leave a deficit of £6953, or roundly £7000, as compared with the Engineer's estimated profit of £1932. We cannot think that the Unemployment Grants Committee have led the Corporation to believe that a grant of 50 p.ct. of the interest will be allowed for a period of fifteen years on the total expenditure of nearly £200,000. Nor can we imagine that the Electricity Commissioners will sanction loans for periods of 25 years for rewinding motors and changing meters and lamps. If assurances of the kind have been given, then it is time such unsound finance and preferential treatment of an industry was exposed by every available means, and the strongest possible protest made in the proper quarters by those adversely affected. Among those adversely affected are the taxpaying gas undertakings of the country and their customers. However, if the authorities do their duty, the financial estimates of the Electrical Engineer of Great Yarmouth will undergo considerable modification before the scheme he has drawn up issues from their hands.

THE INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A meeting of the Council was held at No. 28, Grosvenor Gardens, Westminster, on Monday, April 6; the chair being taken by Mr Charles F. Botley, Senior Vice-President, owing to the absence through indisposition of the President, Mr. J. Ferguson Bell.

There were also present Mr. John Wilkinson, O.B.E. (Vice-President); Messrs. James E. Blundell, J. Wesley Whimster, John M. Campbell, John W. M'Lusky, Charles S. Shapley, C. Dru Drury, and John Terrace (ordinary members of the Council); Messrs. Edward F. Keable (Eastern Counties Association), Harold Davies (Manchester District Institution), James Campbell (North British Association), and Leonard J. Langford (Southern Association); Messrs. Samuel Tagg, J.P., and Thomas Hardie (Past-Presidents); and Mr. W. E. Price (Hon. Secretary).

In opening the proceedings, the Chairman made a feeling reference to the death of Mr. Harry E. Jones, Past-President, and Mr. A. F. Brown, member of the Institution, which had occurred since the last meeting; and the Council's sympathy was suitably expressed.

A message to H.R.H. the Prince of Wales, on his departure for West Africa, was reported, together with the reply to it which had been received from the Prince.

It was resolved to recommend to the members at the forthcoming annual meeting that the sum of £100 be voted to the fund for establishing a memorial to the late Lord Moulton, Past-President of the Institution. Its object is to obtain the sum of £3500 for the conversion of the schoolroom at Kingswood School, Bath, in which Lord Moulton spent so much of his time when a schoolboy, into a memorial hall.

The following candidates were approved for the ballot-list to be issued in connection with the annual general meeting:

For the Class of Member—Messrs. G. E. Anderson, Newcastle-on-Tyne; R. L. Atkinson, Newcastle-on-Tyne; C. Breaks, Ellesmere Port; H. W. Dean, Padiham; John Domain, Ripon; J. E. Dixon, Newcastle-on-Tyne; G. W. Perks, Stockton-on-Tees; and N. Reid, Redheugh.

For the Class of Associate Member—Messrs. A. P. Alexander, South Bank; W. Bell, Reading; F. J. Bengough, Birmingham; E. Birch, Stockton-on-Tees; J. R. Cleator, South Bank; H. E. Cowles, Nechells; W. C. Kimpster, Newcastle-on-Tyne; T. R. Mortimer, Brighouse; and F. Nicholls, Gateshead-on-Tyne.

For the Class of Associate—Messrs. H. P. Clark and F. S. Townend, of London.

The following associate members were approved for transference to the class of member: Messrs. H. Curtis, Macclesfield; D. Muir, Pontypridd; and George Walmsley, Londonderry.

The nomination of officers and ordinary members of Council, for election at the annual meeting, was proceeded with; and it was resolved unanimously that the following be nominated:

President—Mr. Charles F. Botley, Hastings.

Vice-President—Mr. H. D. Madden, Cardiff; the Vice-President remaining in office being Mr. John Wilkinson, Nottingham.

Hon. Secretary—Mr. W. E. Price.

Auditors—Mr. S. Y. Shoubridge and Messrs. Wood, Drew, & Co.

Ordinary Members of Council—Messrs. J. H. Canning, O.B.E., Newport, and Harold E. Copp, Hull.

Members nominated in pursuance of article 40 as ordinary members of Council were reported as follows: Messrs. C. R. Armitage, London; W. H. Bennett, Redhill; George S. Frith, J.P., Runcorn; Leonard J. Langford, Tunbridge Wells; Samuel Shadbolt, South Bank; and Charles H. Webb, M.Sc., Stourbridge.

It was resolved that the London Gold Medal relating to papers read last year should be awarded to Mr. R. E. Gibson, for his paper on "The Construction of New Coal-Gas Works at Garston."

It was reported that the late Mr. Harry E. Jones, the donor of the London Gold Medal, just previously to his lamented death, had transferred to the Institution stock of the Uxbridge, Maidenhead, Wycombe, and District Gas Company, the interest of which would provide for the future award of this medal year by year. The thanks of the Council were expressed, and it was agreed that permission be sought for the medal to be known in future as the "Harry E. Jones London Medal."

The interim report of the Wrought-Iron Tubing Inquiry Committee was presented; and it was reported that the metallurgist appointed to draw-up a specification had just delivered it. This was referred to the Committee for consideration.

The Joint Committee on the Standardization of Gas Flanges presented their report, in which it was stated that agreement had been arrived at between the Committee and the British Engineering Standards Association. Particulars of the standard flanges would shortly be published.

A conference was reported, at which the Institution was represented by Mr. F. W. Goodenough and the Secretary, which had been organized by the Association of Teachers in Technical Institutions on the subject of the "Relationship of Technical Education to other forms of Education and to Industry." An invitation for the appointment of two representatives of the Institution to assist further in this matter was accepted; and it was resolved that their appointment be left with the Advisory Committee on Education.

It was reported that the Transactions of the First World Power Conference had been obtained for the Library for reference purposes; it being recognized that their contents would be of great value to the Institution.

In response to a request of the Non-Ferrous Research Association, it was agreed that the sum of £10 10s. be subscribed in aid of their funds.

Arrangements for the ensuing meeting of the Gas Investigation Committee were considered; and the suggestion that it be held at Leeds on Thursday, May 21, was approved. This arrangement would enable the Committee to inspect the Corbet-Woodall test plant in operation.

It was resolved that the Institution of Gas Engineers should become an affiliated member of the Smoke Abatement League of Great Britain, and that the President and the Senior Vice-President be appointed delegates.

An invitation from the Royal Sanitary Institute for the Institution to appoint two delegates to attend their Congress at Edinburgh from July 20 to 25 was accepted, and Mr. John W. M'Lusky, Glasgow, and Mr. James Campbell, Dunfermline, were appointed to attend.

The details of the arrangements for the forthcoming annual general meeting were considered, including the organizing of the various visits on Thursday afternoon, June 11, and to Derby on the following day.

Blinded Soldiers as Telephone Operators.

It may not be generally known that one of the most successful occupations taught to the blinded soldiers at St. Dunstan's is telephone operating. A large number of these men have found employment with important business firms and organizations in London and the Provinces; and not a few employers state that their boards have never been so well and efficiently managed as by their blinded soldier operator. This may be because the freedom from outward distraction—a natural accompaniment of blindness—enables the blind operator to concentrate on his work to a much higher degree than is possible for a sighted operator, and thus he can maintain an excellent service. St. Dunstan's have several fully-trained men ready for work. There may be some readers faced with a necessary change in their present arrangements who might like to give a St. Dunstan's operator a trial. If so, the authorities at St. Dunstan's Headquarters (Inner Circle, Regent's Park, London, N.W. 1) will gladly supply full particulars. A point to bear in mind is that the employer's liability for his blinded soldier operator is no more than for an ordinary employee. To his employer he is a perfectly normal member of the staff. His special needs as a blinded ex-Service man are the permanent and sole responsibility of St. Dunstan's After-Care Organization.

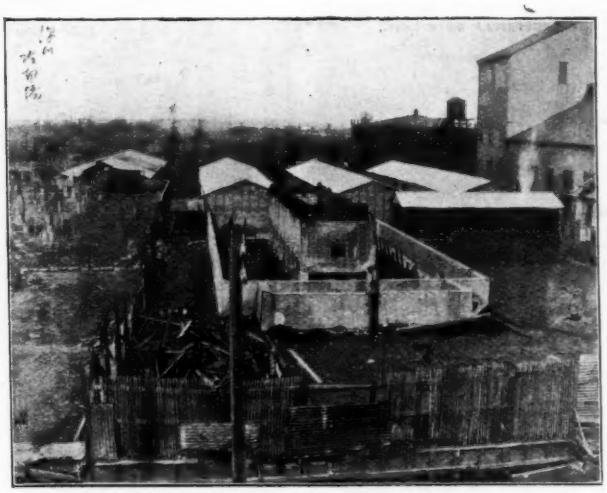
THE JAPANESE EARTHQUAKE OF 1923.

Effects on the Tokio Gas Company.

Tokio suffered severely in the great earthquake which caused so great a loss of life and property in Japan during September, 1923, and of this a full share, of course, fell to the lot of the Tokio Gas Company, who, however, struggled with their difficulties in a manner deserving of the fullest possible praise.

Sunamachi Works.

Fukagawa Works.



Fukagawa Works.

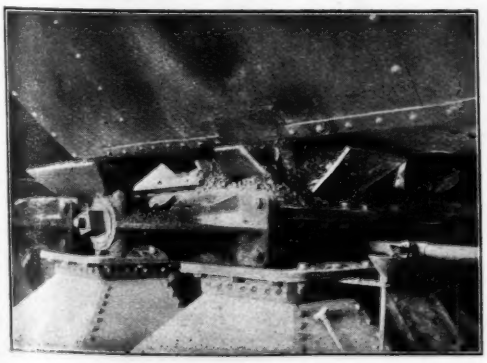
GENERAL VIEWS OF THE CONDITION OF THE WORKS AFTER THE EARTHQUAKE.

An idea of the effect of the earthquake on the Company's works and property generally will be gathered from the accompanying series of photographs, for which we are indebted to Mr. K. Sato, who has recently been visiting this country investigating modern methods of gas manufacture, in order to arrive at some definite conclusion as to the types of plant which, in the circumstances, it is preferable for the Company to adopt.

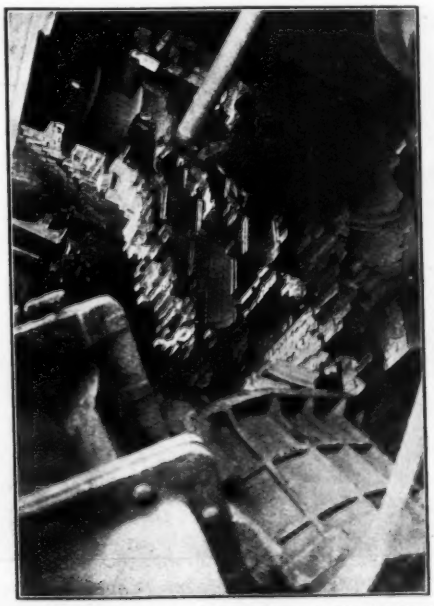
The total capacity of the plants of the Tokio Gas Company—who have five manufacturing stations and two bye-products works—may be placed at about 25 million c.ft. of gas a day, for the supply of the city and suburbs, and the mileage of mains at some 1670. Much damage was done to the 3 million c.ft. per day Koppers coke oven plant at the Omori Works, and to the 2 million c.ft. per day vertical retort installation at the Shiba Works. Damage to a more or less serious extent was also caused to the horizontal, inclined, and vertical retort installations in three other works.

Effect on the Holders.

One of the strangest effects of the earthquake, so far as the gas-works was concerned, was in connection with the holders. Friction resulting from the earth movements caused the emission of weird sounds, and water was discharged in huge quantities. The sight was a terrible one, but closer investigation revealed the comforting fact that the damage was less extensive than at first appeared probable. Particularly in the case of the larger holders, having a capacity of (say) over 1½ million c.ft., the actual damage was really trifling—only the guide-rollers being thrown out of gear. From this experience it may be

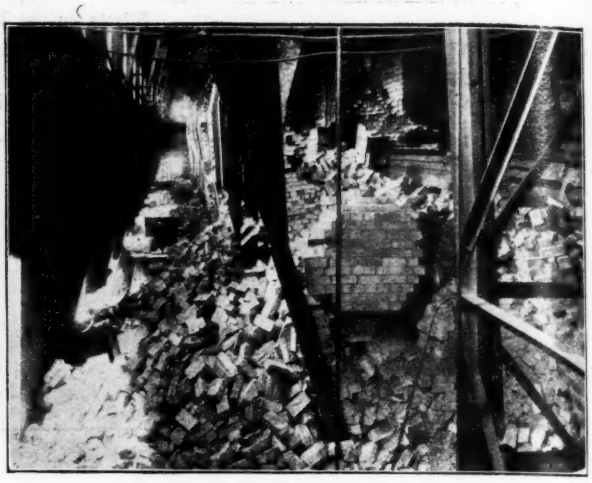


How Coal-Feeding Hopper was Broken Down.
Of the 72 cast-iron hoppers, no fewer than 30 were broken.

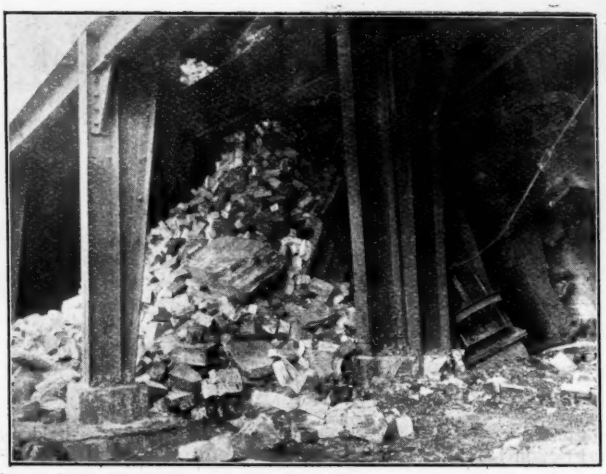


View, from below, of a Broken Down Vertical Retort.

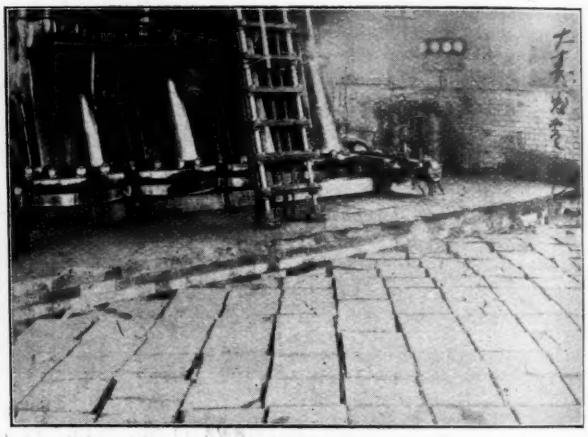
Photograph showing how the Generators were Left.



Side View of Retort Bench.

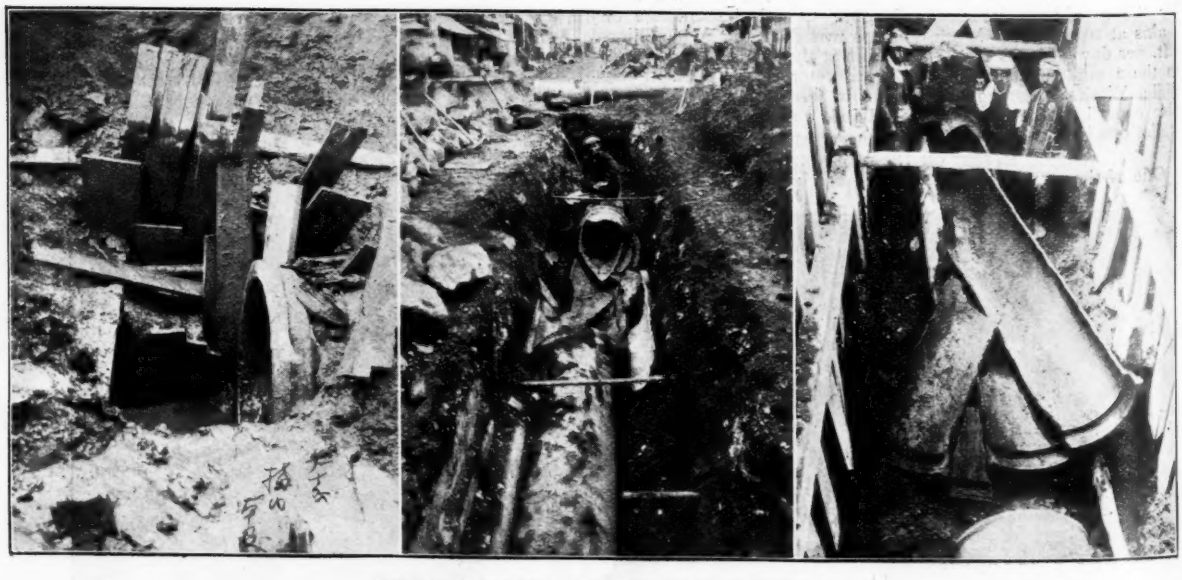


End of a Bench of Nine Settings.



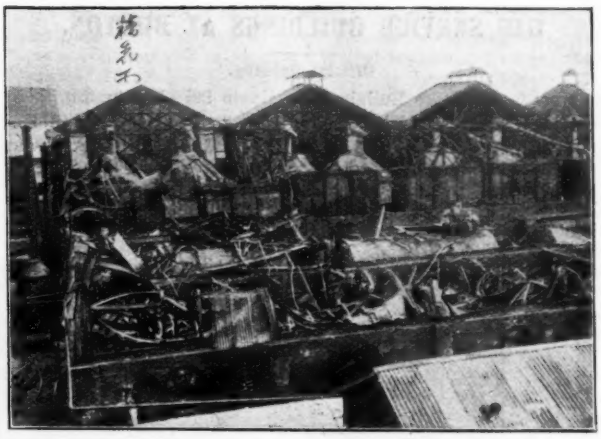
Omori Works—Diesel Engine Power Plant.

It will be observed that under these engines the foundations are of a very solid character, being constructed of concrete. The portion of the floor in the foreground was not constructed in the same way, and suffered considerable disturbance.

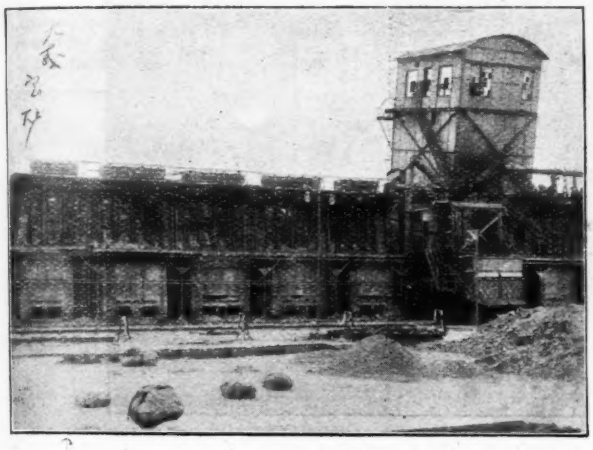


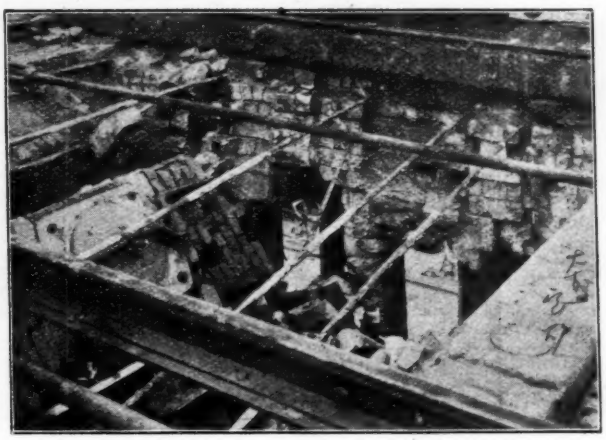
SPECIMEN GAPS IN THE DISTRIBUTION SYSTEM.

The first photograph is of the 36-in. main in the Omori Gas-Works.

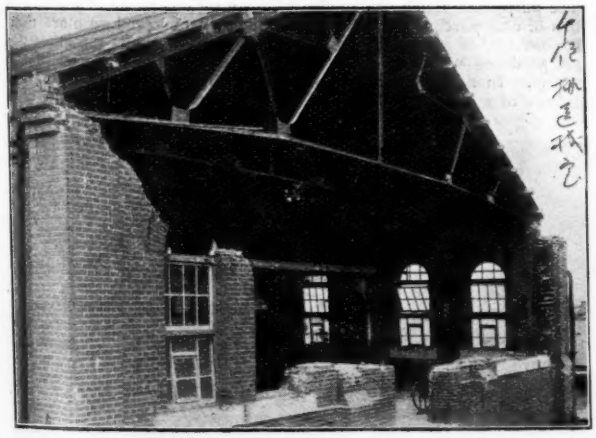


TAR DISTILLATION PLANT AT THE SARUYE WORKS IN TOKIO.
This plant suffered considerable damage.





WRECK OF THE KOPPERS OVENS AT THE OMORI WORKS, NEAR TOKIO.
These ovens had a daily capacity of 3 million c.ft.



SPECIMEN PHOTOGRAPHS OF BUILDING WRECKAGE.

concluded that the construction of a gasholder is sufficiently elastic to enable it to withstand even such a shock as results from a very big earthquake.

Generally speaking, the foundations of the machinery and plant were but little affected; and this applies particularly to the foundations of the settings and gasholders. Therefore the damage to the settings already referred to may be assumed to have been due to oscillation of the structure, and not to the giving way of the foundations themselves.

Of the other plant, that most seriously damaged was a purifying box at the Omori Works, 35 ft. by 120 ft. by 6 ft., made of cast iron and supported by reinforced concrete pillars. The damage to the mains consisted principally of loosened and drawn joints; and the Company have therefore deemed it wise to make careful investigation with a view to ascertaining what may be the most suitable form of joint for future use.

Gas Supply Ceases.

Immediately following upon the earthquake, fire broke out, and from this cause the gas supply was stopped. The most serious damage sustained by fire was, however, in connection with the bye-product plant at the Saruye Works. The holders within the area which was affected by the conflagration remained unaffected—indeed, by acting as a screen, they exercised a restraining influence upon the progress of the flames.

At first it was uncertain how long the gas supply would have to be discontinued, owing to the serious destruction caused by both earthquake and fire; but within three weeks of the disaster, the Company were able to restore the supply to a small district in the city, and within two months the whole of the area was again receiving gas. This indicates the great energy and enterprise displayed by the engineers of the Company in this devastating emergency. The work naturally had to proceed uninterruptedly day and night. It was of a very strenuous character; and, of course, what was then done was of a temporary nature.

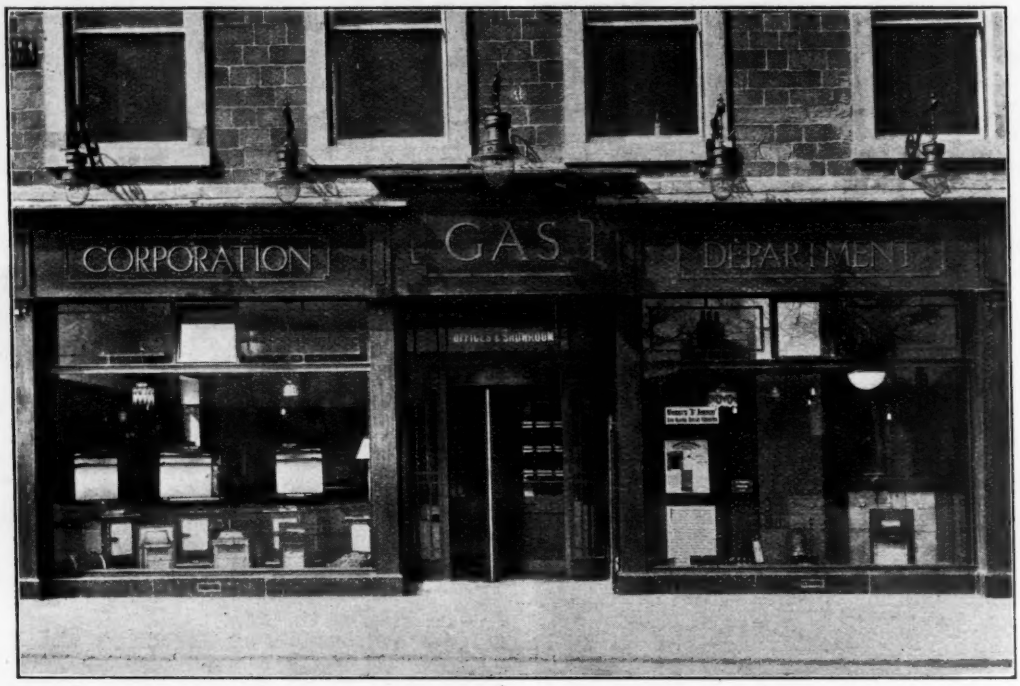
Extensions Contemplated.

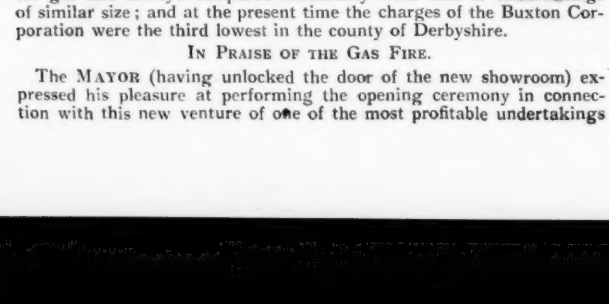
The demand for gas by the citizens is continually growing, and to meet this a scheme has been prepared to extend the capacity from the present 25 million c.ft. daily to some 75 millions.

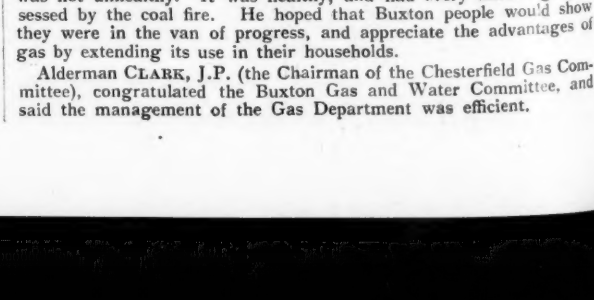
GAS SERVICE BUILDINGS AT BUXTON.

Official Opening.

New Gas Service Buildings on Eagle Parade, Buxton, were officially opened on Wednesday, April 8, by the Mayor (Alderman C. W. Buckley, J.P., M.D., London, M.R.C.P.), who was accompanied by the Mayoress. There were also present a number of members of the Council, officials, and others—including Alderman A. W. Wall (the Chairman of the Gas and Water Committee of the Buxton Corporation) and Mr. F. G. Shaw (the Gas Engineer and Manager). In the course of the proceedings some remarks on gas heating were made by the Mayor, to whose views on the subject great weight attaches by reason of the fact that he is a distinguished consultant on rheumatism, gout, and allied diseases, University Lecturer on Balneology (on which he is a world-renowned authority), and a Director of the Biological and Bacteriological Research Laboratories of the Devonshire Hospital, of which he is also Honorary Physician.







Alderman Wall welcomed those present, and said the gas undertaking had always been a paying concern since it was purchased by the old Local Board in 1870. As the town had grown, the development of the undertaking had been remarkable. The capital outlay was in the neighbourhood of £90,000; and of the loan obtained he was pleased to say they only owed £7000. When the new Town Hall was built, the undertaking gave £2000 towards the cost. He hoped the make of gas would soon reach 200 million c.ft. The price charged for gas had always compared favourably with that of undertakings of similar size; and at the present time the charges of the Buxton Corporation were the third lowest in the county of Derbyshire.

In Praise of the Gas Fire.

The Mayor (having unlocked the door of the new showroom) expressed his pleasure at performing the opening ceremony in connection with this new venture of one of the most profitable undertakings of the town. Gas, owing to the enterprise which had always marked the undertakings of the country, had developed into a science of heating to an extent which had been of the greatest possible benefit to the country. He was disposed to say that there was no more efficient method of heating in the present day than by gas. He indicated the advantages in the household of gas over coal, and said that gas would help to dispose of the smoke problem. The smoke problem in Buxton was not so serious as in some towns; but it was quite serious enough. They knew of what value sunlight was to the nation and the individual, especially the children. Therefore he wanted them to do all they could to eliminate smoke from the atmosphere; and the method ready to hand was the use of gas for domestic heating and cooking. The Corporation realized that the first step towards the solving of the smoke problem was to put their own house in order. They had done this, and now it was their duty to point out that black smoke could be avoided by the use of gas for heating or coke for furnace purposes. Black smoke also meant a serious waste of fuel. Ten tons of coal purchased at about 35s. per ton would produce more than 130,000 c.ft. of gas, which meant, at the present price of gas, that the gas produced would be of greater value than the coal placed in the retorts. In addition, 10 tons of coal produced 7 tons of coke, 175 gallons of ammoniacal liquor, and 100 gallons of tar, which in turn produced oil and certain substances used in the dyeing process. He wondered, also, how many of them had not occasion to take drugs derived from coal-tar products in the gas-works, or to use antiseptics. He mentioned aspirin, phenacetin, sal volatile, lysol, and salvarsan, and added that they would see that there was infinite value in the bye-products of coal. If a ton of coal were properly used, twice its original value was derived from it in the long run. Therefore he advocated the use of gas for heating and cooking. The gas stove was not unhealthy. It was healthy, and had every advantage possessed by the coal fire. He hoped that Buxton people would show they were in the van of progress, and appreciate the advantages of gas by extending its use in their households.

Alderman Clark, J.P. (the Chairman of the Chesterfield Gas Committee), congratulated the Buxton Gas and Water Committee, and said the management of the Gas Department was efficient.

Mr. J. Mason Frith, J.P. (the Chairman of the Runcorn Gas Company), also congratulated the Committee on the fitting-up of so fine a building for the purposes of gas service.

The Mayor, Alderman Clark, and Mr. Mason Frith were thanked for their remarks; and silver salvers were presented to the Mayor and Alderman Wall by Mr. Shaw, who thanked the Corporation for the way in which they had supported him. The Mayoress was presented with a handsome bouquet by Mrs. Shaw.

The company afterwards inspected the buildings, and subsequently took tea at the Eagle Hotel.

Coping with Growing Demands.

Modern conditions and the ever-increasing use of labour-saving gas appliances have called for improved methods of catering for the consumers; and with the expansion of Buxton new premises for the distribution department have been urgently needed for many years. Soon after his appointment in 1911, Mr. Shaw reported on the matter, and the old gas showroom was opened in 1914—the war preventing developments then in contemplation. Soon after the end of the war the matter was frequently before the Gas Committee; and after many schemes had been considered, a portion of the Old Devonshire Hotel was acquired. The site presented many advantages. It enabled the workshops, offices, stores, and showrooms to be concentrated in one building, with proper supervision and control, and provided a good display site near the Town Hall. The workshops are reasonably isolated from surrounding property. A further valuable portion of the scheme is the provision of three workmen's flats on the second floor; and these are occupied by employees of the department, who are at constant call at night for urgent repairs and other emergencies.

The whole of the work of reconstruction has been carried out by the Gas Engineer and his staff, with the aid of local contractors, and has been paid for out of revenue.

New Showrooms, Offices, and Workshops.

Before the move to the new offices, the staff was split-up. The fact of having all the departments under one roof will make both for economy and efficiency; and, what is even more important, the fine showroom and demonstration room will materially assist the department in their progressive sales policy. The appointments of the ground floor showroom and office are in oak. To the right upon entering is a semi-circular counter and the office accommodation for the clerks. From the showroom, a staircase leads to a small waiting room and the demonstration room, in which are many gas appliances in full working order.

The portions of the building already referred to are those which will be seen by the public. Returning to the ground floor, a long corridor leads to the back of the building—workshops and stores being situated on either side. The stores are also on this floor.

On the first floor, behind the demonstration room, are the Gas Manager's office and other offices, the public lighting department and street lamp store, stock rooms, the official gas testing station, &c.

INSTITUTION OF GAS ENGINEERS.

EDUCATION SCHEME.

By Walter Hole, Organizing Secretary.

Now that the revision of the scheme is completed, it is thought that a brief description, setting forth the whole of the arrangements in the simplest possible language, may be acceptable to those for whom the scheme is intended.

The junior educational work of the Institution is now grouped in three main divisions—viz.:

I. Craftsman's division, dealing with gasfitting.
II. Intermediate division.
III. Professional division.

I. Gasfitting Course.

The first division deals with the training of gasfitters as craftsmen, and is arranged in conjunction with the City and Guilds of London Institute. The course for this subject, which is open to lads of 16 years of age and upwards, runs for five years. Instruction is given not only in the technics of gasfitting and the utilization of gas, but also in the elements of the sciences upon which those technics are based. The examinations consist of written, practical, and *vivâ voce* tests. The certificates gained in the final year of the course will be endorsed by the Institution of Gas Engineers, and will therefore be a very valuable possession of the successful candidate. Full particulars of the regulations, syllabuses, and centres of instruction may be obtained from Mr. C. C. Hawkins, Superintendent, Department of Technology, City and Guilds of London Institute, No. 29, Roland Gardens, Old Brompton Road, London, S.W. 7.

II. Minor Grouped Courses in Gas Engineering and Gas Supply.

There are many men in the industry, alike on the works, on the district, and in the office, who cannot see their way, or have no desire, to qualify for professional status on the commercial or engineering sides of the industry, but who are desirous of learning more of the processes and transactions of the industry in which they are daily engaged. For these, Minor Grouped Courses have been arranged in conjunction with the City and Guilds of London Institute, under the following heads:

1. Gas-works practice.
2. Gas supply practice.

The course for each of these runs for two years, with an examination at the end of the second year, and comprises instruction in the general principles and elementary details of gas-works practice or gas-supply practice, and in the sciences of mechanics, physics, and chemistry, of which gas manufacture and supply are practical applications. By taking an additional year's tuition, a successful candidate in gas-works practice may be admitted to the examination in gas supply practice, and *vice versâ*; so that in three years anyone desirous and capable of so doing may obtain certificates in both subjects. All certificates gained in these examinations will be endorsed by the Institution of Gas Engineers.

Provision has been made in this section for isolated students—those so unfortunately placed geographically that they cannot possibly attend any of the classes arranged. These may apply for examination to the City and Guilds of London Institute through the local education authority. If the candidate is accepted, and is successful in the examination, he will be awarded a City and Guilds Certificate; but this will not be endorsed by the Institution of Gas Engineers. Any further information regarding these Minor Grouped Courses, together with a list of the schools at which instruction is provided or examinations are held, may be obtained from Mr. C. C. Hawkins.

III. Professional Courses.

The third division is concerned with professional training in both gas engineering and gas supply. Each of these subjects is divided into three grades—the Ordinary, the Higher, and the Diploma.

The regulations for the Ordinary Grade require attendance in a course occupying not less than 150 hours per annum for three years. Such a course includes, in addition to gas engineering and gas supply, instruction in foundation subjects such as mathematics, physics, chemistry, and/or engineering, upon which the successful study and practice of gas engineering or supply depends. At the end of the three years' course the student is examined, and, if successful, receives the Ordinary-Grade Certificate in Gas Engineering or Gas Supply, which indicates the ancillary subjects studied, as well as the degree of success attained in the main subject—namely Distinction, First Class, or Second Class. These Certificates are issued by the Institution of Gas Engineers, signed by the President and Secretary, and endorsed by the Board of Education.

The course for the Higher-Grade Certificate in both gas engineering and gas supply occupies another two years of not less than 150 hours per annum, in which further instruction in the ancillary subjects previously studied, or in alternative subjects, is given, in addition to the main subjects of gas engineering or gas supply. As a general rule it is recommended that a student in gas engineering taking an Ordinary Grade Course in which special emphasis is found to be laid upon chemistry should devote himself to engineering subjects in the Higher Course, and *vice versâ*.

Entrance to the Higher Course is restricted to those who possess either the Ordinary-Grade Certificate, or some equivalent qualification, such as the National Certificate (Ordinary) of the Institution of Mechanical Engineers or of the Institute of Chemistry. No one may be awarded the Higher-Grade Certificate who is not engaged on the practical (as distinguished from the clerical) side of the main subject of study (gas engineering or gas supply). As in the Ordinary Grade, the Higher-Grade Certificate is awarded by the Institution of Gas Engineers, endorsed by the Board of Education, and will denote the class (Distinction, First Class, or Second Class) in which the candidate has been placed, and the ancillary subjects studied.

Courses in one or both of the above subjects and grades are being provided at the following Technical Institutes: Bath Municipal Technical College, Barnsley Technical School, Birmingham Municipal Technical School, Blackburn Municipal Technical College, Bournemouth Municipal College, Bradford Technical College, Bristol Merchant Venturers Technical College, Burnley Municipal College, Derby Municipal Technical College, Dewsbury Technical College, Glasgow Royal Technical College, Halifax Municipal Technical College, Huddersfield Technical College, Leeds Central Technical School, Regent Street Polytechnic and Westminster Technical Institute (London), Manchester Municipal College of Technology, Plymouth Municipal Technical School, Portsmouth Technical College,

Salford Royal Technical College, and Stoke-on-Trent Central School of Science and Technology.

Where convenient and advisable, the earlier years of the course may be taken at other schools, with the previous consent of the Advisory Committee.

The Principal of any of the foregoing schools will be pleased to give the fullest information to intending students.

The exact character of the courses taken varies naturally with local circumstances and conditions. Perusal of the following courses of study which are being taken at three of the above Colleges will, however, be an indication to students of the lines upon which the Education Scheme is being worked.

Typical Courses in Gas Engineering.

	Senior Course.			Advanced Course.	
	1st Year.	2nd Year.	3rd Year.	1st Year.	2nd Year.
A	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Physics Th. and Pr. Inorganic Chemistry Th. and Pr. Organic Chemistry Th. and Pr.	Physical Chemistry Th. and Pr. Organic Chemistry Th. and Pr. Gas Engineering		
B	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Chemistry Th. and Pr. Chemistry of Gas Manufacture Gas Engineering	Chemistry Th. and Pr. Gas Engineering	Chemistry Th. and Pr. Gas Engineering
C	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Inorganic Chemistry Th. and Pr. Organic Chemistry Th. and Pr. Gas Engineering Drawing	Mathematics Mechanics Th. and Pr. Engineering Drawing	Building Construction Mechanics and Heat Engines Th. and Pr. Gas Engineering

Typical Course in Gas Supply.

	Senior Course.			Advanced Course.	
	1st Year.	2nd Year.	3rd Year.	1st Year.	2nd Year.
D	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Mathematics Physics Th. and Pr. Chemistry Th. and Pr.	Mechanics Th. and Pr. Building Construction Gas Supply	Building Construction Mech. and Electrical Technology Gas Installation Work Gas Supply	Physics or Building Construction Gasfittings Design Gas Supply

It is, of course, understood that the above Senior Courses refer to the Course for the Ordinary-Grade Certificate, and the Advanced Courses to that for the Higher-Grade Certificate.

Section II.

It is hoped that year by year the above list of colleges providing instruction in gas subjects will be gradually increased until personal tuition in these subjects will be within the reasonable reach of all but the most exceptional cases. Meanwhile it is obvious that considerable areas of the country are at present untouched. Provision has therefore to be made for the certification of those to whom attendance at classes in gas engineering or gas supply is absolutely impossible. These are provided for in section II. of the scheme.

Under the provisions of this section, students who can satisfy the Advisory Committee that it is impossible, owing to geographical position, for them to attend the Grouped Courses arranged under section I., and who at the same time are also able to satisfy the Committee, either by the production of certificates gained, or by the voucher of the principal of an approved school, that they have attained the requisite standard in any three of the specified ancillary subjects (mathematics, chemistry, physics, mechanics, machine drawing, building construction, and heat engines) may be allowed to sit for examination in gas engineering or gas supply.

For the Ordinary Grade this requisite standard in ancillary subjects has been defined as "not inferior to that of the third-year senior course of an approved technical school." The examinations are of standard equal to (and are held at the same time as) those under section I. The successful candidate is awarded a Certificate by the Institution of Gas Engineers, signed by the President and Secretary, showing the degree of success obtained, and the ancillary subjects studied, but which is not endorsed by the Board of Education.

The examination is restricted to those who have been engaged on the practical side of the main subject of study (gas engineering or gas supply) for at least one year previously. Forms of application to sit for these examinations, and any further information necessary, may be obtained from the Organizing Secretary, Mr. Walter Hole, "Wharfedale," Barton, Torquay. The forms must be returned not later than the last day of February in any year.

Entrance to the Higher-Grade Examination in either gas engineering or gas supply under section II. is restricted to those who have

(*a*) been engaged on the practical side of the main subject of study (gas engineering or gas supply) for at least three years;
(*b*) obtained the Ordinary-Grade Certificate in the subject of examination; and
(*c*) are able to satisfy the Committee that they have received and profited by further instruction in the ancillary subjects taken for the Ordinary Grade, or, alternatively, in others approved by the Advisory Committee.

The questions in this section are the same as for the corresponding grade in section I., and the examinations are held at the same time. Successful candidates are awarded a Certificate signed by the President and Secretary of the Institution of Gas Engineers, denoting the degree of success obtained (Distinction, First Class, or Second Class) and indicating the ancillary subjects studied; but this Certificate is not endorsed by the Board of Education.

In both the Ordinary and Higher Grades in this section an examination fee of one guinea is charged. Application forms and any further information may be obtained from the Organizing Secretary.

Diploma.

The Diploma is the crown of the whole scheme, and is the highest certification granted within the industry. The Diploma may be obtained in either gas engineering or gas supply, and denotes that the holder not only has high academic attainments, but also possesses practical experience and skill. Examination for the Diploma is restricted to those who

(*a*) are actually engaged in the industry;
(*b*) are 23 years of age or more;
(*c*) have obtained the Higher-Grade Certificate in the subject of examination and the Ordinary-Grade Certificate in the sister subject (gas engineering or gas supply);
(*d*) have passed the Matriculation Examination of any recognized British University, or possess the Higher School Certificate A or B, or have attained other general educational qualifications of not lower standard.

The examination is divided into three portions—viz., the written, the oral, and the presentation of a thesis. The last-mentioned, if the candidate is a gas engineering student, must consist of an original paper on some point of gas-works construction or gas manufacture. If the candidate is a gas supply student, it must take the form of an original paper on some point of gas distribution, supply, or utilization. The thesis must be sent to the Organizing Secretary at least four weeks before the date of the written examination.

The oral portion of the examination is directed to eliciting the candidate's personal experience and capacity to deal with the various difficulties, emergencies, and problems which are continually being met with in actual practice—qualifications which cannot be determined so well by any written paper.

No candidate who already possesses an approved degree in gas engineering in a British University is required to sit for the written portion of the Diploma examination. But he is required to present a thesis or published work of his own; to submit himself to a *viva voce* examination; and to produce evidence of professional experience satisfactory to the Advisory Committee.

As in section II., an examination fee of one guinea is charged in the Diploma division.

Application forms for entrance to the examination, and any further information required, may be obtained from the Organizing Secretary, Mr. Walter Hole, "Wharfedale," Barton, Torquay.

A Meter Connection Protector.—A patent has been taken out in the United States by Mr. G. H. Sauton in connection with a device for completely enclosing and locking the coupling unions or nuts of the connecting pipes of a gas meter, in order to obviate any possibility of tampering with the couplings by unauthorized persons. The enclosing device is fastened by a concealed lock, which it is said will resist all tampering efforts of wires, &c., for the purpose of unfastening it. The intention is to number serially each meter protector, and to supply only one number of each series to any one gas undertaking. Thus, in the event of a customer breaking a protector he will be unable to replace it, as the meter reader will be instructed to insert the number of the protector on his sheet at each reading of the meter. The device is so constructed that it can be preserved whenever a meter is changed.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

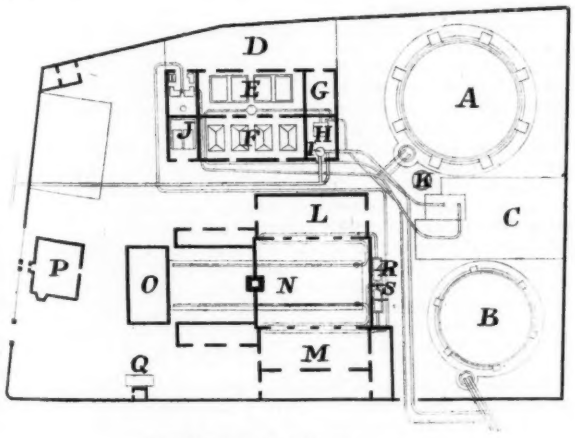
PRESIDENTIAL ADDRESS OF MR. F. A. WEST, OF NEWARK (APRIL 22).

During the 37 years the Eastern Counties Gas Managers' Association has been in existence it has fulfilled its object with distinction. This must be a source of pride and satisfaction to the few remaining original members, who first laid the foundation of this combined effort for progress and the future development of the gas industry in the Eastern Counties.

The District Associations continue to play an important part in the scientific advancement of the industry; and the complex nature of a modern gas engineer's duties tends to make it more necessary than ever to maintain these Associations in a high state of efficiency, so that the problems and experiences met with in various works can be mutually discussed and progress made on the right lines. The more scientific methods of manufacture and distribution, and the wider choice of plant available, make it difficult for an engineer responsible for the economic and sound administration of his undertaking to decide on future extensions. It is only by mutual service to each other that we can maintain the high reputation which has placed the industry in its present sound position.

Newark Gas-Works.

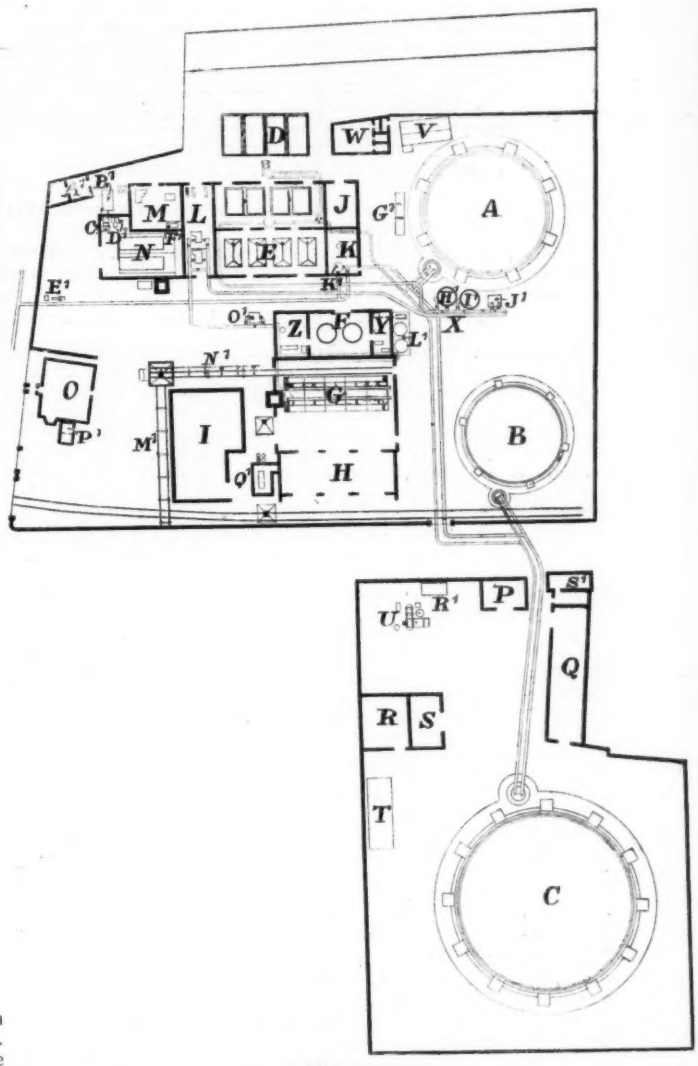
The Newark gas undertaking has been in existence 90 years, and during that period has experienced both prosperous and lean times. You have had an opportunity to-day of examining the present works. When I took charge, they were perhaps one of the last remaining examples of the old school. The main retort house was direct fired and hand charged, and all the rest of the plant dated from the same period. The plant was originally designed for an output of 300,000 c.ft. per day. The entire works have recently been reconstructed on the existing site; and with the exception of utilizing existing buildings, there is practically nothing of the old works left. In the gradual rearrangement of plant on the existing site, and carrying out one's statutory obligations at the same time, advantage cannot always be taken of placing various apparatus in the best relative positions. However, it was a much sounder proposition than erecting a new works on a new site—the only alternative. The two plans show the works as they were and as they are now.



NEWARK GAS-WORKS, 1918.

The existing plant is capable of turning-out over a million c.ft. a day; three-quarters of a million of which is coal gas. The retort house is only 52 ft. wide; and with 20 ft. for the charging machine and 20 ft. for the retorts, there is left 12 ft. for the discharging side. But for a comparatively small retort house with an efficient coke handling plant, it works very satisfactorily. The retorts are 23 in. by 16 in. by 20 ft. long, with 7 in. ascension pipes each side; and the dip-pipes are fitted with Cort's anti-dips. We work with about 12½ cwt. charges in twelve hours, and charge every six hours. We get a very regular flow of gas and even quality, and arrange the retort house governor to give a level gauge in the retorts. The accompanying charts show the vacuum on the retorts and the outlet of the retort house governor, and the calorific value supplied to the town. The whole arrangement is very simple and efficient.

We obtain fairly good results. The average yield for the past twelve months was 72·3 therms, using South Yorkshire and Nottinghamshire coal. Working costs are economical. When four beds are at work, we make 140,000 c.ft. per stoker. This includes everything in connection with the retort house, clinkering furnaces, removing ashes, sweeping up, &c., and coke handling, but does not include elevating coal. One man discharges all the coal and elevates this into the overhead coal hopper. The temperatures are moderate, averaging 1300° to 1330° C. in the combustion chambers; and the charges are not very heavy. But it is hoped, working in this way, to obtain a long life from each setting of retorts. In the ordinary routine of works control, the temperatures of the combustion chambers and draughts on the settings are taken daily, with temperatures and pressures on all the plant throughout the works, sulphur compounds, oxygen content, CO_2, ammonia in clean gas, calorific value, gas engine meters, water meters, and boiler feed water tests for hardness, &c. All these are charted daily, with very little trouble; and, as "coming events cast their shadows before," trouble can often be avoided by giving the charts a few moments' consideration. Analyses of flue gases, complete gas analyses, tests of purifiers and scrubbing plant for efficiency, naphthalene tests, &c., are made whenever required.



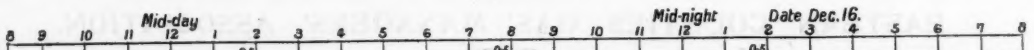
NEWARK GAS-WORKS.

Coke Handling Plant.

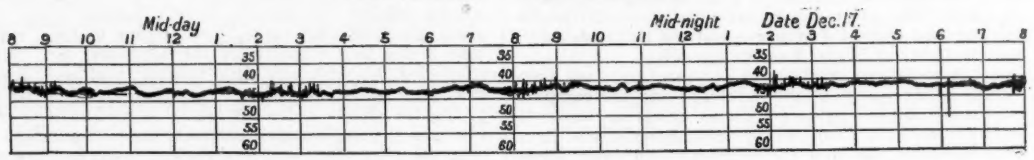
The coke handling plant is, perhaps, somewhat novel. This was made by a local engineering firm, and was constructed largely out of second-hand steel work pulled down from the old retort house. The first cost was low; and there is nothing much to wear out. The stoker on the discharging side can operate it without going outside the retort house. It consists of a bottom discharge bogey running on rails in front of the retort bench, extended up an inclined railway into a coke bunker. The bogey is pulled either way with an endless rope operated by an electric motor, which is controlled by a tramway-type controller in the retort house. The bunker is lined with 3 in. of concrete, and the hopper portion with 3-in. firebricks, to prevent corrosion.

Another travelling skip of half-a-ton capacity runs at right angles, and conveys coke out of the bunker into railway trucks on the siding, and also, if required, stores coke in the yard. The reason a steel bunker was erected instead of ferro-concrete was, as I mentioned before, that practically the whole arrangement was constructed out of old material we had on the works.

One rather unusual point about it is that the coke is screened as it leaves the hopper, and not before it is put into it. This,



INLET, RETORT HOUSE GOVERNOR.



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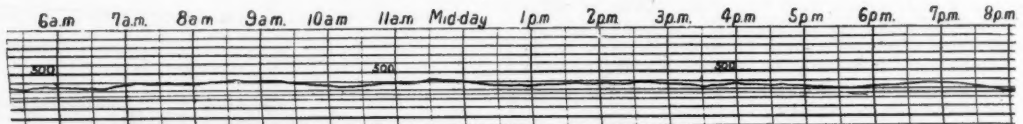


CALORIFIC VALUE SUPPLIED.

of course, is because the hopper is small, and there was not sufficient room to erect a large range of hoppers. Also, first cost was again a consideration.

Constant Quality of Gas.

While there are admitted advantages for almost any gas-works to be equipped with alternative methods of gas manufacture—such as coal gas, water gas, &c.—there are also decided disadvantages. In the smaller works, it is very rarely an economical proposition to run two different types of plant at the same time. The best efficiency cannot be obtained out of either. It is an established fact that, to obtain the best results out of almost any plant, it should be worked to its full capacity; and, while there is an advantage in being able to control the local residual market to some extent with an auxiliary gas plant, the greatest disadvantage with modern practice is varying quality. Present-day requirements for all-round satisfactory results entail constant pressure, composition, and specific gravity. Varying quality—even only to the extent of a few B.Th.U.—means dissatisfaction on the part of the consumer.

There is a wide difference in some cases between actual loss or leakage in thousands of c.ft. and actual loss in B.Th.U. made and sold on the declared value. There is a tendency to increase pressures gradually, necessitated by increased consumption on existing mains. Probably future developments will see the gradual introduction of higher pressures to ensure that every consumer is supplied at a constant figure throughout the 24 hours, irrespective of the amount he, or any other consumer, happens to be using at any time. Unvarying composition and specific gravity are very real necessities for general satisfaction. This is, perhaps, most noticeable in industrial heating and furnace work. Smaller works that are equipped with one type of plant only for manufacturing gas are in a better position to attain this ideal; and every effort should be made to do so, not only in their own interests, but in the interests of the whole gas industry.

Experience with Low-Grade Gas.

We have gradually increased our declared calorific value from 410 B.Th.U. as we have improved our position. My experience with a low-grade gas has not been of the happiest. While a 400 B.Th.U. gas gives excellent results if the apparatus is adjusted properly, I found the cost of distributing it under modern conditions excessive. We supplied a 410 B.Th.U. gas, for the simple reason that we had no plant to provide any better. Our old retort house was in such a dilapidated condition that it was impossible to work to a higher standard consistently; and for a considerable period we manufactured a large proportion of water gas or complete gasification gas. This relieved our over-taxed purifying plant, and helped us over a difficult coal period. I also seriously considered the possibility of a complete gasification plant, eliminating the retort house altogether; and this method of manufacture was tried-out very thoroughly before deciding to proceed with further alterations to the retort bench. At that period I was optimistic enough to believe this was the future gas, and the most economical to manufacture; but under our present conditions I found it was not the cheapest to sell. As the make per ton went up, the leakage also went up in direct ratio, until we reached the alarming figure of 20 p.ct.; and there seemed to be no finality about it.

After very careful investigation, I came to the conclusion that the only sound way to get back to a normal figure was by increasing the calorific value. Our case may be abnormal, though I cannot but feel that our experiences will also apply to some extent in other places and under similar conditions. I must explain that before I took charge at Newark the gas for some considerable time had not been purified as well as it might have been, and the insides of mains and services were something like an oxide purifier where rust had accumulated. Also, we were deficient in scrubbing power, and a considerable amount of ammonia was going forward. Dry meters that had been fixed twenty years and more had never been brought in for testing and overhauling. We opened our own meter repair shop, so that careful investigation could be made of the meters; and though during the period we were supplying a 410 B.Th.U. gas we sent out for two years a pure gas—that is to say, free from sulphur, SO_2, HCN, &c.—we made no headway with our meters. We sprayed meters with a suitable gas oil, and also pumped a special paraffin into the gas, as we continue to do now for naphthalene.

The insides of the meters were pitted with tiny spots the size of a pin's head, and this on both the leathers and the casing. When the meter was first opened, these appeared like small globules of water; but after the moisture had evaporated, white spots were left on the leather and rusty spots on the tin. The leather in course of time got dry and hard, and the oil all drained to the bottom of the case. The meter began to register fast; then the leather cracked (slightly at first), and the meter gradually registered slower and slower, until ultimately it stopped. The gas seemed to contain an abnormal amount of aqueous vapour; and this, together with a fairly large quantity of ammonia (often 2 to 4 grains per 100 c.ft.), condensed on the insides of the meters. No doubt small particles of rust containing a large percentage of sulphur were also carried forward to the meters from the mains and services. The low-grade gas also appeared to have a tendency to absorb or scrub out most of the oil from the leathers; and this left them in a state suitable for rapid decay.

It may be possible to distribute a low-grade gas successfully with dry meters, providing every trace of impurity is removed; but I think even then the gas would absorb or tend to release the oil out of the meter leathers. At any rate, since supplying a 475 B.Th.U. gas our leakage has been reduced by 7 p.ct. in two years—from 20 to 13 p.ct.—which I think is sufficient evidence that we are now on the right lines. The hydrocarbons in the richer gas protect the leathers, and the gas apparently does not tend to extract the oils out of the leathers so readily.

While there is no doubt that much of our meter trouble is in our own hands, I am equally certain that much of it is due to the makers. In the course of our investigations I visited many meter works, and the methods of preparing diaphragms vary very considerably. While some makers still follow the old-fashioned way of pickling the leathers for months, others adopt newer methods of preparing them; but the fact remains that, with us at any rate, leathers prepared in the old way are the most satisfactory.

Control of Pipes and Fittings.

The "carbon monoxide bogey" has been allowed to rest lately. In fact, Mr. Butterfield's report has finally killed it, and incidentally has done a great service to the gas industry. The summing-up of this report reflects the modern tendency of our industry's chief aim in one word, "service." Personally, I think we should take more interest in our consumers' gas affairs. Standard specifications should be drawn up for all fittings and pipes, and every local plumber or ironmonger made to work to them under our supervision. This principle has been adopted in Newark. Some years ago we incorporated in our Act power to specify what size of pipes should be used in houses; and we now require all architects, builders, plumbers, &c., to work to our specification. We have a well-trained inspector periodically calling at every house to inquire, and

actually see for himself that everything is working satisfactorily; and I am quite convinced it is an economical scheme, as many small defects are discovered and put right which would otherwise eventually cause a consumer to be dissatisfied.

The general policy of all up-to-date gas undertakings should be service to the public, if we are to keep abreast with the times and meet competition successfully. The amount of such service will no doubt be increased more and more. It is certainly better to charge an additional 1d. or 2d. per 1000 c.ft. and give thorough satisfaction, than to sell cheaper gas and not trouble about the consumers getting good results. The average gas-fitter is, I believe, a more educated and better trained man than the type of years ago; and many undertakings make special provision for training their fitters in the theory of distribution. It is local plumbers and ironmongers who are generally to blame for unsatisfactory work. Probably one result of Mr. Butterfield's report will enable us to remedy this in the future. Competition is undoubtedly an excellent thing; but it is not in the best interest of anybody to have to compete with the cheap unsatisfactory burners and apparatus on the market, which all gas engineers know to be inefficient. If we are going to be subjected to more regulations and responsibilities, we might do well to imitate the water-works people, and have competent fitters authorized — allowing only such authorized fitters to do gasfitting.

It is placing a large responsibility on gas undertakings to maintain all fittings and apparatus in their district in first-class order; and this may have a tendency to make some consumers careless, from the knowledge that the gas company are responsible for anything that may happen, and not themselves. To carry this scheme to a logical conclusion, it should be made a finable offence if a consumer neglects to notify a gas undertaking when anything is wrong, or if he permits any outside fitter to fix apparatus that is not of approved type. Escapes are sometimes noticed for days without being reported; but I believe in some towns, if a consumer neglects to report a leaking water tap in his house, he is liable to a fine. Many gas companies encourage the police, road men, &c., to report escapes, by giving them a small reward every time a proved escape is reported.

However, the ordinary risks of gas poisoning are very small; and it is quite reasonable to assume that if everybody had an all-gas house, the annual death-rate would be reduced very considerably in this country, by the abolition to an enormous extent of fogs and smoke.

From Company to Corporation.

The Newark gas undertaking is just passing into the hands of the Corporation; and it is interesting to note how this originated. There is no central electricity generating station in Newark, though there are two or three small private companies supplying current for shop lighting. The Corporation were desirous of having their own works; and it was considered that a plant worked in conjunction with the gas-works would be the most economical to commence with, both as regards capital outlay and working costs. As it was considered in Newark that the Gas Company would have too much of a monopoly, the undertaking was offered to the Corporation; and there is no doubt that, if the latter manage the concern carefully, the transfer will benefit Newark in years to come.

While there is much to be said both for and against municipally-owned gas-works, one of the chief drawbacks of company-owned undertakings at present is that there is no really sound system of depreciation of capital, and when a company is faced with a large capital and a collection of old plant the position is serious. This is more pronounced perhaps since the war. Capital costs of plant have increased enormously; and it is conceivable that when large extensions are necessary, due to increased business, the capital costs will increase their capital ratio per million out of all proportion to what they have been used to. This they will probably have to carry for all time. There does not seem to be any probability for many years to come of obtaining the same proportion of plant out of revenue as many works have done in the past.

A municipally-owned works with a sinking fund has an advantage here. Of course, in some cases this advantage is not turned to the best account, if excess profits are used in large sums annually to relieve the rates. The determining factor in turning the scale in favour of gaseous fuel is that of cost; and it is necessary that no obstacle, whether in the form of rate subsidies or anything similar, should be allowed to oppose this policy. Having regard to the true functions of a municipality, the question of mere monetary profit should be quite secondary; and with a view to securing the universal use of gas, with its attendant benefits to the community, it should be sold at the lowest possible price consistent with protecting the ratepayers from any loss.

Electricity in Newark.

It has finally been decided in Newark to purchase electricity in bulk from the Notts and Derby Power Company. Possibly, all circumstances considered, it is the solution from an electrical engineer's point of view; but there is a much broader view —a national outlook on the whole subject. Much has been said and written about super-electrical stations, and how electricity is going to revolutionize this country; but most of these would-be reformers seem to miss the main point. It cannot be repeated too often that the chief natural resource and prime mover in this country is coal. In order to take full advantage of this, and make the best use of it, as much as possible of this coal should be carbonized; electricity being made from the bye-products, either gas or coke.

Electricity can only be viewed in this country as a bye-product of coal; any other way of regarding it is to shut one's eyes to facts. It has been amply proved that our own industry is much more efficient in its utilization of the raw material than is electricity. Of course, in countries where water power and other natural resources are available, the position is entirely different. Most small towns can generate their electricity cheaper at the gas-works, either by gas engines or waste-heat boilers; and when one considers that there is a staff and organization already in existence, it is difficult to see where the economy is in a separate undertaking.

Mr. Chaney suggested some time ago that a Gas Commission should be established to work in conjunction with the Electricity Commissioners. It appears the obvious solution. With a super-generating station equipped with extremely large units and every possible refinement in the boiler and power houses, a thermal efficiency of about 20 p.ct. is obtained in the process of generating electricity from the raw coal by way of steam; and there is no prospect of effecting any great improvement. It seems tragic that this is the best a super-power station can do; 80 p.ct. of the coal used going to waste up the chimney. Possibly in the future power production will be developed by the internal combustion engine, whose higher efficiency will displace the steam engine. Many electricians themselves admit that, unless they can generate current by water or other natural means, they have very little hope of producing much cheaper electricity.

Coal Economy.

The economical use of coal will have to be more seriously considered in this country in the future; and all the help and encouragement possible, both by legislation and otherwise, should be given to the gas industry to produce cheap gas. Low-temperature carbonization continues to make strenuous efforts to prove a commercial success. There is a low-temperature carbonization plant in operation in the Eastern Counties, combined with a complete gasification plant which is intended to replace the existing retort house. Results from this will be watched with interest. Complete gasification would, if carried out on a large enough scale and properly applied, result in an enormous saving of the nation's coal; but the elimination of the retort house, and the general distribution of a gas with comparatively low calorific value, will not come yet.

Perhaps the solution is by enriching with low-temperature gas. Mr. Evans some time ago pointed out, in one of his lectures, that, assuming there were 300 therms in a ton of coal, with modern gas-works practice 72 therms would be recovered as gas, 17 therms as tar, and 199 therms as coke, giving a total of 288 therms. With low-temperature practice 35 therms would be recovered as gas, 26 therms as tar, and 223 therms as coke, giving a total of 284 therms. It would therefore appear that the system is not so efficient at the outset as modern high-temperature carbonization. At Newark we have actually obtained 200 therms per ton of coal in the form of gas out of a complete gasification plant; a combined plant should certainly produce a larger number of therms as gas than modern gas-works practice. Even assuming the total thermal efficiency is somewhat less than present practice, if the capital costs are less and operating costs lower than with a modern retort house, it might be a paying proposition.

Strenuous efforts are constantly being made to produce cheap gas; and the modern tendency seems to favour amalgamation of the smaller concerns with the larger. It is obvious that in many cases economies can be effected and better service given to the public in this way. It is certainly a necessity to practice economy in these days; and we can only view with grave concern the general attitude of labour in this respect. If every labour organization adopted for its motto: "A square deal—a fair day's work for a fair day's pay," we should soon again be on the high road towards prosperity as a nation. The men who work are those who bear the load; and nothing but a policy of national thrift will lift the heavy debt of taxation which is oppressing commercial enterprise.

Future of the Gas Industry.

Apart from efforts to manufacture cheap gas, very real progress is being made in the efficiency of apparatus to use gas. We are having a paper this afternoon on a method of using gas for industrial purposes which claims to be a very great advance on older methods. Sir Arthur Duckham, in a paper at the World Power Conference, pointed out that for many years the low cost of labour and the apparently high cost of coal gas prevented manufacturers from considering the use of the latter, but gradually it was coming to be realized that the actual cost of fuel was not the only consideration, for so much depended upon subsidiary questions—such as transport, storage, and cost of handling and utilization. In an attempt to form a basis as to what industry could afford to pay for gas as compared with solid fuel, he pointed out that a ton of coal has a potential heat value equivalent to 290 therms. Taking the value of coal delivered to a works at 35s. per ton, the cost per therm would be 1·45d. The heating efficiency of the raw coal

fire or furnace is not, on the average, greater than 25 p.ct., whereas the heating efficiency of a gas furnace is 70 p.ct. Taking the cost of gas at 4·4d. per therm, which is the selling price of some undertakings for large quantities, the comparative figures are 5·8d. for coal and 6·28d. for gas for every therm actually utilized. Gas is, therefore, on this basis, under 8 p.ct. more costly than coal as a fuel. This is, no doubt, in many cases easily compensated for by the many advantages attached to the use of gas.

Possibly very large developments in the further use of gas in industry are not far distant; and it only goes to show the growing importance of every undertaking of any size concentrating on the distribution of gas and organizing an efficient distribution department. I feel confident, as every other gas engineer, that the gas industry has a very great future before it. It is quite possible that it will develop into the premier industry in this country, as coal is our greatest national asset, and at present we are showing the nation how to use it in the most economical manner. When it is remembered that there are over 16 million gas cookers and fires in use in this country, and that the Gas Light and Coke Company alone produce in a year approximately as much energy for light, heat, and power as is produced in the form of electricity by the whole of the electrical undertakings in Great Britain, there is no need for the suggestion that gas is on the wane.

Publicity.

I am afraid there is still a great tendency for us, as an industry, to "hide our light under a bushel." We do not shout enough, but are content to go quietly along, letting our goods advertise themselves. Imagine how the "Daily Mail" would advertise the fact if they had a circulation of 16 million copies, or supplied as much printed matter as all the other daily papers in London put together. Too much is left to the "B.C.G.A." Many undertakings are content to pay their annual subscription, and let their publicity work stop there. If every gas undertaking advertised intelligently in the local papers, the "B.C.G.A." could devote more time and energy to telling the country what the gas industry is doing for the nation. We know the usefulness and national importance of our work; but the very fact that we have been in existence over a hundred years is sufficient to lead people to believe that we have had our day, and that it is only a matter of time for the newer arrival to supplant us. Many who consider themselves well informed say as much, and we shall have ourselves to thank if that theory grows.

I am sure that, if the electrical industry in this country could do as much for the conservation of coal and the abolition of the smoke nuisance, the whole country would never be allowed to forget the fact. It would appear that we as an industry are not sufficiently assertive; and probably the majority of us still have a feeling at the back of our minds that advertising is a little *infra dig.* We compromise by producing something very nice and quiet and artistic, and console ourselves by saying that, after all, it does not matter very much—gas advertises itself. Gentlemen, it is a mistake. The time has arrived to let the country know what are our capabilities, and in no uncertain manner. If the business world knew as much about us as we know ourselves, there would be a general demand to gasify the country instead of electrifying it; and it behoves us therefore to educate politicians.

Political influence is responsible largely for the present state of affairs; and it seems a remarkable thing that gentlemen with no real knowledge of the subject should be in a position to force the country into a policy which will eventually mean an expenditure of many millions, with no corresponding advantage. There has been of late a strong tendency among politicians to boost electricity at all costs; and I believe that much of that tendency has been caused through lack of knowledge. There is a large field for both gas and electricity, in which both can work for economy, efficiency, and the improvement of the atmosphere of our towns. Anything that will assist in bringing more sunshine into our lives should be welcomed and encouraged, not for our own sakes, but for the future health, wealth, and prosperity of the nation. The sooner this fact is realized, and coal is viewed as stored sunlight, the happier and better will it be for future generations.

"B.C.G.A." South-Western District Conference.—Arrangements have been made for a British Commercial Gas Association South-Western District Conference to be held in the Plume of Feathers Hotel, Minehead, on Friday, May 8, under the presidency of Mr. J. H. Ellis, President of the "B.C.G.A.," and Chairman of the Plymouth and Stonehouse Gas Light and Coke Company. In the morning Mr. John Burgess, J.P. (the Chairman of the Minehead Gas Light and Coke Company, Ltd.), will welcome the visitors, and Mr. Edwin P. Vince (the Company's Manager and Secretary) will read a paper entitled "Local Publicity and Service Methods of a Fifty Million Works." Luncheon will be followed by a public conference in Newcombe's Café, The Parade, when an address on "The Modern Labour-Saving House" will be given by Mrs. Robert Noble (Consultant on Home Hygiene, Furnishing, and Equipment).

CONSTITUTION OF COAL.

At a meeting of the London Section of the Society of Chemical Industry, held at the Royal Society of Arts, Adelphi, on Monday evening, April 6, Prof. W. A. Bone lectured on the subject of "The Constitution of Coal"—indicating some of the lines of inquiry into the matter which have hitherto been pursued, and offering some suggestions with regard to future investigations.

At the outset, he informed his audience that he was not going to tell them what is the constitution of coal, for the simple reason that he did not know. Of late years there has been a great deal of research on the subject of coal—certainly it has not been in want of investigators or of money to urge it forward. Yet, if one took a candid view of the situation, one would conclude that not much of fundamental importance is being found out about the chemical constitution of coal. Very little more is known of this matter to-day than was the case twenty years ago. For the fact that present research is not making such progress as might be wished, he did not think that the researchers were to be blamed; but he suggested that the time has arrived when the organic chemist must take up the matter. The fact must never be lost sight of that, coal being an organic substance, its constitution can only be finally determined by methods adopted with other organic substances. He explained that in this country there does not exist a very wide range of coals, and put forward the view that the subject has suffered from the fact that many of the investigators have only been considering coal as it is known and used here. They should not limit themselves to bituminous coals. In other countries there are many varieties of less matured coals; and these also must be considered in order to arrive at a satisfactory explanation of the chemical constitution of coal.

At one point in his lecture, Prof. Bone said he thought it had been suggested that the cause of the coking properties of coal resides in the vitrain; but personally he did not believe this, and he had the best of reasons for not believing it. He directed attention to samples of coal which, though they may contain considerable quantities of the jet-like substance called vitrain, will not coke at all. It may be, he added, that there is a connection in the case of some of the bituminous coals, but he doubted it. One must look elsewhere for the cause of the coking properties of coal.

Showing by the aid of lantern slides results which have been secured by him, Prof. Bone explained that he does not like the use of pyridine as a coal solvent, so he has ceased to employ it for the purpose. He prefers in its place to use benzene under very high pressure. There is no gas evolved during the benzene extraction in the case of bituminous coals. There may be some slight change in the coal substance, but it does not involve any breaking-down of the coal structure itself. The crude extract is obtained in this way, and then fractionated in a manner which he described.

Some discussion followed the lecture—or "conversation," as Prof. Bone preferred to term it. Dr. Lessing remarked that, the further one went into coal research, the greater seemed to be the field of ignorance one met with. It would be only by the combined work of a great many investigators that they would eventually be able to see a little more clearly. Prof. Bone had rightly laid stress on the fact that the organic chemist must take a part in this research. Without paying considerable attention to the question of coal formation, it would be impossible to get nearer the subject of constitution, because the two were closely linked together. He (Dr. Lessing) was responsible for attributing the coking properties of coal to the clarain and vitrain portion. There was no difference in fact between Prof. Bone and himself; for the component in younger coals from which clarain and vitrain were formed was non-coking. Moreover, the material into which these components changed on further maturing, say into anthracite, was also devoid of coking properties. Dr. Scholtz expressed the opinion that the substitution of benzene for pyridine was a very important step. Dr. Harold G. Colman said much good work had been done, and made reference to the products resulting from the extraction with benzene, which he agreed was a great improvement on extraction with pyridine; but he thought that some decomposition of the coal must have taken place under the conditions of the experiment. Prof. Bone, in reply, said he adopted benzene as being the least objectionable substance for the purpose.

"An Introduction to Technical Drawing."—This is the title of a work by W. Abbott, B.Sc., which is to be published by Messrs. Blackie & Son, Ltd., No. 50, Old Bailey, E.C. 4, in three parts at 2s. 6d. net each. The publication is designed to meet secondary and central school requirements; ample work having been included in the three parts to cover a three years' course. After completing the course, students will be in a position to begin specialized work in one or more branches of technical drawing—machine design and construction, building construction, &c. The author has included a good deal of plane and solid geometry in the course. We have received a copy of Part I., and feel sure that it will prove exceedingly useful.

SAFEGUARDING OF GAS ENGINES.

A great deal of practical information was contained in a paper which Mr. G. STEVENSON TAYLOR, O.B.E., A.R.C.Sc., A.M.I.Mech.E. (H.M. Senior Engineering Inspector of Factories), read at the last meeting—held at St. Bride's Institute, E.C.—of the Institution of Engineers-in-Charge.

The subject of the paper (which was illustrated by a series of lantern slides) was "The Safeguarding of Prime Movers and Transmission Machinery;" and, of course, a good deal of consideration was given to the proper fencing-off or covering-in of the moving parts of gas and oil engines. The author pointed out that the requirement as to fencing of every part of a water wheel or engine and every flywheel is absolute, though it may be so situated that no danger or liability to accident is likely to ensue from its position. Similarly it has been held that the bevel gearing of an engine governor must be securely fenced, though the engine itself was fenced. Again, all machinery from which, in the ordinary course of working, danger may reasonably be anticipated—though such danger may arise by reason only of careless working or of external causes—must be securely fenced. Upon the occupier of every factory rests the responsibility of ensuring that his machinery is securely fenced; but exactly what may be regarded as secure fencing for a particular engine or part of machinery will depend to some extent on local circumstances and the knowledge and experience of the person concerned.

Considering more particularly the safeguarding of the parts of prime movers and transmission machinery, the following are regarded as the essentials of a satisfactory safeguard:

(1) It should prevent access to the dangerous part so long as the danger exists.
(2) It should be constructed of such materials, and in such a manner, as to withstand the wear and tear to which it is likely to be subjected.
(3) Wherever practicable, it should form an integral part of the engine or machinery, and have been considered in its design.
(4) Its removal should not be necessary for the purpose of lubricating any part of the engine or machinery, or for changing belts, gears, &c.

The selection of a suitable material for the construction of safeguards is a matter of the utmost importance, but unfortunately often receives very scant attention. When substantially and firmly constructed of sound timber, wooden guards for such parts of machinery as pulleys, belts, small flywheels, and shafting can be both neat and effective. However, the use of wood for guards has several disadvantages. It is easily splintered or broken, and thus unsuitable for rough usage; it readily absorbs liquids, and is therefore unsuitable for positions where it may be splashed with oil, &c.; and it increases the fire risk. Cast iron is a particularly suitable material for the safeguarding of many dangerous parts of engines. Guards of this material can be designed so as to form an integral part of the engine, and to meet all other conditions. Sheet metal, of suitable gauge, is an excellent material for guards—especially for those required on existing machinery, though there is no difficulty in making provision for such guards in the design of a machine. A sheet-metal guard should be supported on a strong framework of angle bar or rod, and it should be made by skilled workmen. Rods, tubes, and bars of metal are suitable for some classes of safeguards, particularly those which are effective at a distance of about 18 in. from the part of machinery to be guarded. Unless this is the case, these materials should not be used, except with small spacing, or in conjunction with sheet metal, wire work, or expanded metal. Wire work and expanded metal are similar materials for guard construction, except that expanded metal often has a somewhat sharp edge, which may cause cuts. Much may be said in favour of these materials if they are used of suitable gauge and mesh, and properly secured to strong framework. Millboard, *papier mâché*, and similar materials, have mainly been used in the construction of some patented types of safeguards for revolving shafting. Where, as on overhead shafting, they are not subjected to rough usage, such safeguards have proved effective, and have lasted for some time.

Dealing with individual safeguards, Mr. Taylor said it is very desirable that, wherever practicable, an engine should be installed in an engine house. The side of such a house often constitutes part of the fencing for a flywheel or other moving part of the engine. The use of wood for the fencing of engines is not recommended, for reasons already stated, and also because it is likely to be of inadequate strength. Flywheels—and particularly those on large gas engines—are frequently found with excellent fencing on the outside, but on the side near the crank a single rail placed 6 or 7 in. from the flywheel has been regarded as sufficient, though the attendant has to approach this side at intervals in order to feel the bearing. In all such cases additional guards of sheet metal or wire mesh extending just beyond the crank shaft bearing are necessary. A number of horizontal gas and oil engines are now supplied by the makers with the cranks, and in some cases the connecting rods, enclosed in sheet-metal casings. This system has also been adopted by some makers for these parts on large horizontal steam engines. Many high-speed vertical steam engines have the crank chambers completely enclosed; and with the exception of the flywheel and governor there are no exposed moving parts on these engines. The same is true of many large vertical gas and oil engines.

On steam, gas, and oil engines, where the valves are operated by means of a separate valve, cam, or lay shaft, this is usually driven from the crankshaft by means of bevel, skew, or worm gears. These gears should be guarded by means of sheet or cast-metal casings; and such casings are generally fitted by the engine makers. A certain number of accidents have occurred on the cam shafts of gas and oil engines, though many engine makers and users appear to be unaware of this danger. These shafts are usually carried fairly close to the engine framing, and are best fenced either by means of a sheet-metal apron guard attached to the framing or by enclosure in a metal casing. On vertical gas and oil engines—including Diesel engines—the vertical or inclined shaft transmitting motion from the main engine to the cam shaft should be encased. This is done by several engine makers.

Many of the fatal accidents in connection with engines are due to the bursting of flywheels caused by failures of governors. Some of these arise from faulty design, and others from wear or slackness. The maintenance of the governor and governor gear in proper working order is therefore a matter of primary importance. Wherever possible, some trip device, speed control, or stop motion should be fitted, in order to prevent racing of the engine in the event of the governor failing. It is not uncommon to find engines with a length of the main shaft projecting beyond the flywheel, or even beyond the outer flywheel bearing. Such shafting should, of course, always be fenced; and this is best done by means of a tube or sleeve. Any other accessible parts of the main shaft should be guarded in a similar manner, or by means of suitable rail fencing.

Air-Driven Wire Brushes for Holder Cleaning.

A short time ago, the People's Gas Light and Coke Company, of Chicago, were confronted with the problem of how best to clean the outer surface of one of their 5 million c.ft. holders. Describing the method adopted, the "Compressed Air Magazine" states that the holder had not been painted for more than two years, and had reached a state which called for prompt and radical attention. The two bottom lifts were in a particularly bad way. In consequence of the action of the water and the air, the paint had become blistered, and much of the metal was covered with a thick coating of rust. The three upper lifts were not so much in need of attention, and could be made ready for re-painting with comparatively little work. Therefore the cleaning of these lifts was accomplished by hand. The two bottom lifts were cleaned with air-operated wire brushes; the air for the purpose being furnished by a portable compressor. The wire brushes did their work well; and the foreman in charge declared that it would not have been possible to do it satisfactorily by hand. The metal between the rivets was deeply corroded; but the high speed of the pneumatic wire brushes enabled them to get between the rivets and clear away the rust and scale preparatory to painting. Furthermore, the mechanical brushes saved a great deal of time, and lightened the work of the men.

Gas Used in Producing Shell Flakes.—A Monterey (California) inventor has, says the "American Gas Journal," perfected a method for converting abalone shells into beautiful flakes for stucco work. Each year abalone produces a layer of new shell. The inventor treats the shell chemically, and then places it in a special gas-heated stove, where it is permitted to remain for a certain length of time, which results in the disintegration of the various layers of shell. After this the shell is run through a grinder, which flakes it, producing a Roman gold effect that is permanent. In applying the flakes for stucco work, the walls are plastered, and then the flakes are pushed by hand or compressed air into the wet stucco.

The Late Mr. H. E. Jones.—The April issue of the "Wandgas Magazine"—the Journal of the Wandsworth, Wimbledon, and Epsom District Gas Company—contains affectionate references to the late Chairman by the Chief Engineer and the Secretary. Mr. C. M. Croft says of Mr. Jones: "Always proud of his profession, in which he obtained the highest honour; always busy, but never too busy to help another, he leaves this world the better for his long life, spent in untiring service for the public good—the ideal of every true gentleman. The loss to us is irreparable; but his memory will be a lasting pleasure, and his life an example and ideal for us all." Mr. C. W. Braine says: "There was nothing of unctuous piety about him, and he did not wear his heart on his sleeve. He was intensely human. His friend, the Rev. Hugh Chapman, well expressed his attitude towards religion in his address at the memorial service in London, and spoke of a quality of justice, coupled with good fellowship. These were not mere words."

THE HYDROGENATION AND LIQUEFACTION OF COAL.

Two years ago H. G. Shatwell and J. Ivon Graham commenced a series of investigations on this subject; and the results of their work have been published in "Fuel in Science and Practice." Concerning the hydrogenation of coal, Bergius has drawn what appears to the authors to be a somewhat artificial line of demarcation between coals containing less than 85 p.ct. of carbon (ash-free basis) and those containing more than this amount. The former he considers may be readily converted into a thick oil under certain experimental conditions, leaving nothing but the ash; while of the latter only a certain proportion is liquefied. As it seemed possible that the coals of less than 85 p.ct. carbon content used by Bergius were lignitic in character, while those of over 85 p.ct. resembled steam coals of high carbon content, the authors considered that the treatment of a highly oxygenated non-coking bituminous coal would be of special interest, in view of the desirability of finding for such coals an industrial application apart from their use as a fuel for household purposes. It was decided to test the action of hydrogen at high pressures (100 atmospheres and over) and at a temperature in the neighbourhood of 400° C., on the microscopic ingredients. A series of several experiments showed that hydrogenation of clarain in the dry state was unsuccessful from the point of view of oil formation. In subsequent experiments a liquid medium—phenol, except in one instance—was employed, in which clarain, durain, and fusain were treated.

HYDROGENATION WITH GAS OIL AS MEDIUM.

In the first experiment, 150 grammes of coal and 400 c.c. of a gas oil were heated with hydrogen during 4 hours to a maximum temperature of 415° C. and a maximum pressure of 110 atmospheres. After cooling, the residual gas was released, and treatment continued with fresh hydrogen during 3·5 hours. The product was partly solid and partly liquid. Approximately 40 p.ct. of the coal was converted into liquid.

HYDROGENATION WITH PHENOL AS MEDIUM.

Clarain hydrogenated in the presence of phenol during 3 hours at 416° C. and 123 atmospheres caused absorption of hydrogen of over 2 p.ct. The recovered material was 56·2 p.ct. soluble in phenol and 20 p.ct. insoluble; there being a loss of 23·8 p.ct. The soluble portion yielded 53 p.ct. to chloroform with 47 p.ct. insoluble, each portion being a brown solid, but that soluble in chloroform having a low melting point. The chloroform-soluble powder contained about 7 p.ct. of hydrogen. This product represented 29·6 p.ct. on the original clarain. Hydrogenated in the presence of phenol for 13 hours, clarain gave 37·7 p.ct. of oil soluble in ether. Heated in the presence of phenol in an atmosphere of nitrogen, clarain gave a yield of 8·3 p.ct. of material soluble in phenol.

Durain was hydrogenated in the presence of phenol during four days, a fresh supply of hydrogen being admitted at the beginning of each day's run. It was found that 4·49 p.ct. of hydrogen had been absorbed. The product consisted of 37·5 p.ct. insoluble residue, 7·5 p.ct. of a brown powder soluble in phenol, but insoluble in ether, and 37·5 p.ct. of an oil soluble in ether; there being a loss of 17·2 p.ct.

Fusain.—The fusain was a soft variety of high carbon content obtained from the No. 2 Rhondda seam, South Wales. Hydrogenated under the same conditions as employed with durain, very little change took place, there being recovered 95 p.ct. of an insoluble residue which appeared to be but little altered.

Hydrogenation of a Coal of High Carbon Content.—This sample from the Graigola seam, South Wales, had the following ultimate analysis: Carbon, 91·54; hydrogen, 4·32; sulphur, 0·84; nitrogen, 1·45; and oxygen, 1·85 p.ct. Hydrogenated in the presence of phenol during 9 hours at a maximum temperature of 430° C. and a maximum pressure of 137 atmospheres (average about 130), 55·4 p.ct. was found to be soluble in phenol, of which 47 p.ct. was soluble in ether—*i.e.*, 26 p.ct. on the original coal (on an ash-free dry basis). Heated at ordinary pressures to 600° C., this coal gave only 2 p.ct. of tar oil and water, very slight decomposition taking place up to 420° C.

GENERAL CONCLUSIONS.

(1) The possibility of hydrogenating coal under high pressures and at temperatures between 400° and 436° C. has been definitely confirmed, and substantial yields of liquid products have been obtained.

(2) The nature of the liquids so prepared has not been elucidated. They appear to contain oxygen; and it will be a problem for future investigation to determine if this oxygen is eliminated by further hydrogenation, and hydrocarbons thereby obtained.

(3) The statement by Bergius that coal containing more than 85 p.ct. of carbon is difficult to liquefy is refuted. South Wales coal appeared to be hydrogenated almost as readily as South Staffordshire coals, whereas the fusain experimented with was relatively inert.

(4) The nature of the action of phenol or a mineral oil in accelerating liquefaction is not clear. It was thought that the liquid medium might exert a solvent action on the coal, and that hydrogenation of the coal material in solution would then proceed readily. Experiments, however, prove that this view, as regards the clarain used, is untenable, while the work of Illingworth suggests that it is equally invalid with the coal from the Graigola seam. In the light of some of the results, it seems probable that hydrogenation of coal can take place in the absence of a liquid medium, but that the viscous liquids produced cover the surface of the coal particles and prevent further access of hydrogen. The presence of a solvent will remove the hydrogenated product, thus leaving a new surface exposed to the action of the hydrogen.

(5) It is significant that the yields of products soluble in phenol from the clarain and durain are approximately the same, and that the liquids obtained give almost identical analytical figures. This would appear to be further evidence in support of the view put forward by Tideswell and Wheeler that the clarain and durain from the same coal contain constituents of similar chemical type.

(6) The heavy losses experienced in the treatment of the clarain and durain (both containing substantial proportions of oxygen) are due to excessive gas formation, the production of water, and probably also to the formation of phenols, which were removed in the subsequent technique.

SMOKELESS FUEL AND OIL.

A Meeting of the Manchester Section of the Society of Chemical Industry was held at the Textile Institute, Manchester, on Friday, April 3—Dr. H. Levinstein presiding. A paper entitled "Smokeless Fuel and Oil" was read by Dr. C. H. Lander, Director of Fuel Research in the Department of Scientific and Industrial Research.

The lecturer said that, in 1890, the late Mr. Scott-Moncrieff proposed to carbonize coal, or to make a fuel which he hoped would be a better fuel than gas coke, by withdrawing gas coke from the retorts before it was properly carbonized. This was the germ of the low-temperature carbonization process. It was not, however, until 1906, when the late Mr. Thomas Parker, of Birmingham, took out a patent for Coalite, that the subject received special attention. In 1912 the advantages of such a process were realized from a different angle. The Rt. Hon. Winston Churchill, who was then at the Admiralty, appointed a Committee, under the late Lord Fisher, to go into the question of fuel for the engines of the Navy. At that time there was a possibility of Diesel engines being used in the Navy. That Committee went very carefully into the question of the possibility of providing a home supply of fuel oil. There were no known natural oil supplies in this country capable of serious commercial exploitation. The Scottish shale oil industry survived with difficulty; and both the quantity and the quality of its output were gradually diminishing. The large shale deposits of Norfolk and Kimmeridge, though fairly rich, were not suggested as a possible source of oil supply for this country. The Commission were therefore brought back to the consideration of coal. Two distinct industries were concerned with the carbonization of coal—the metallurgical coke industry and the gas industry. After considering the possibilities, the Commission rather negatived the idea of further supplies of oil being obtained from these two industries in the form in which they existed. Of course, any new industry would probably knit itself on to the two older ones. In 1913, the Commission reported that the most hopeful method of obtaining adequate supplies of fuel oil for the Navy and Mercantile Marine during peace-time, and to a certain extent in war-time, lay in following up the suggestions of Parker for the production of Coalite. Large quantities of oil could then be obtained, by ordinary carbonization methods, together with some gas. There were 35 to 40 million tons of coal per annum burned in the domestic grates of this country, with enormous waste from both the thermal and the chemical points of view. The more valuable of the constituents of the coal simply went up the chimney, polluting the atmosphere, and causing great damage. If this enormous amount of coal could be diverted through some carbonization process in such a manner as to produce the maximum amount of oil, the minimum amount of gas, and a good smokeless fuel, great advantage would result. Dr. Lander then explained the work done at H.M. Fuel Research Station at East Greenwich.

At the conclusion of his paper, the lecturer referred to the Bergius process. A great deal of interest was being taken in this matter; and the plant was extremely interesting. As a matter of fact, the Bergius Company were seeking for a cheaper raw material than oil. Some people said that the so-called hydrogenation of oil was simply pressure-cracking. There was, indeed, a controversy as to whether it really was hydrogenation. The whole problem was being carefully investigated in Germany.

Mr. A. F. Browne, whose death occurred recently, at the age of 74, left estate of the gross value of £7712, with net personalty £7571.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

On Friday last, April 17, members of the Association met at the Westminster Technical Institute, Vincent Square, S.W. 1, to hear and discuss a paper on "Fuel in Industry" by Mr. Dean Chandler, who is in charge of the Industrial Furnace Laboratories of the South Metropolitan Gas Company. The paper was accompanied by an index of articles on the industrial uses of gas which have appeared from time to time in the "Journal," and also by a series of interesting photographs of gas furnaces. It has not been possible to publish all these illustrations; but a good selection is reproduced.

Mr. W. Newton Booth, who occupied the chair, in introducing Mr. Chandler, emphasized the importance of the use of town gas as an industrial fuel.

FUEL IN INDUSTRY.

By Dean Chandler, of the South Metropolitan Gas Company.

[Extracted.]

The problem to-day is to determine the best and most economical methods of using our coal. Briefly, there are four methods at our disposal:

1. It may be consumed in the raw state in domestic grates and industrial furnaces.
2. It may be wholly converted into gas in suitable producers, as originally proposed by Mond.
3. It may be burnt in pulverized form.
4. It may be subjected to processes of distillation, known as carbonization.

It is generally conceded that (1) is extremely wasteful and often inimical to health. Cases in London have come to my notice where 5 therms have been used in the form of raw coal to do the work which has subsequently been accomplished by 1 therm by means of town gas. Alternatives (2) and (3) are for certain large-scale operations justified, providing the right class of coal is employed for the purpose. Alternative (4) is, however, the rational method of treating bituminous coal—namely, to subject it to a heat-treatment process by which it is possible to recover all those valuable distillates which are otherwise lost when raw coal is burnt. At present only about 30 million tons in the United Kingdom are so treated—16½ million tons at gas-works and 13½ million tons by coke-oven plants.

Unfortunately for the electrical industry, the generation of electric energy must be classed under (1), since the general practice to-day is to burn raw coal for this purpose. This common

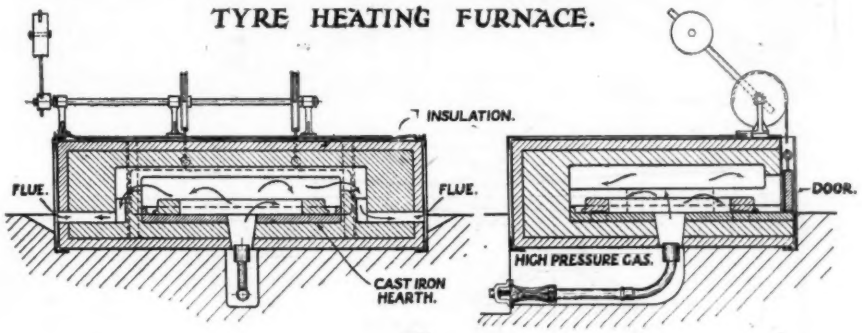


FIG. 1.

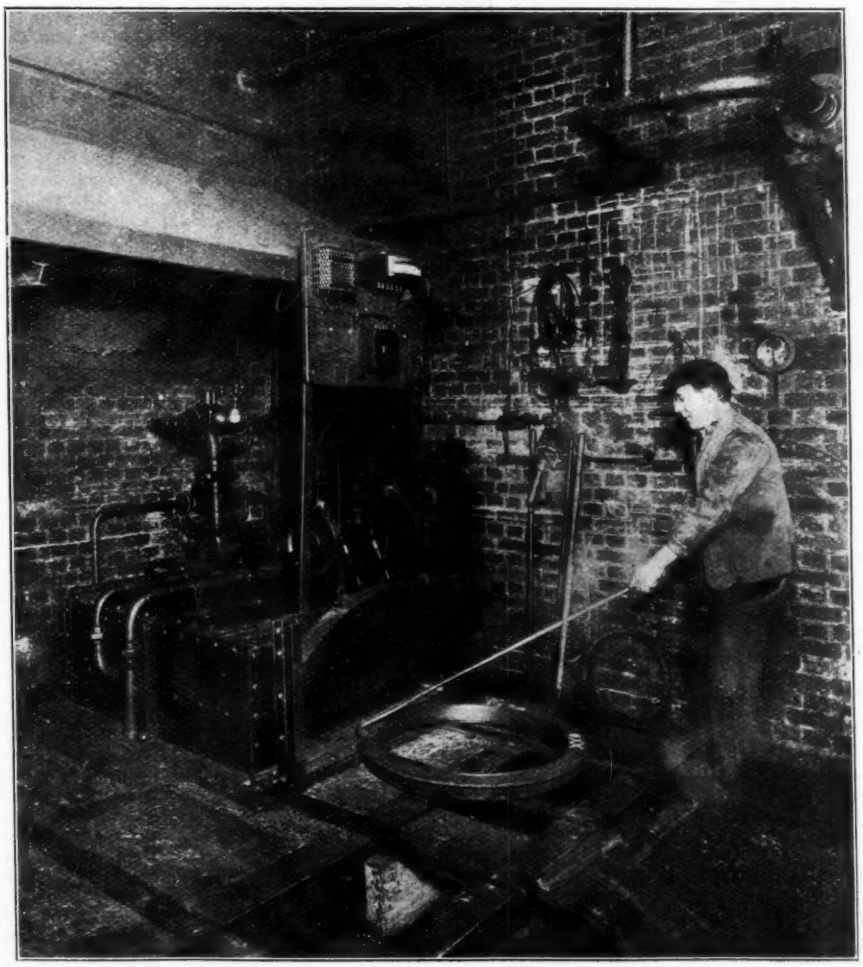


FIG. 2.—TYRE HEATING FURNACE, L.C.C. TRAMWAY DEPARTMENT.

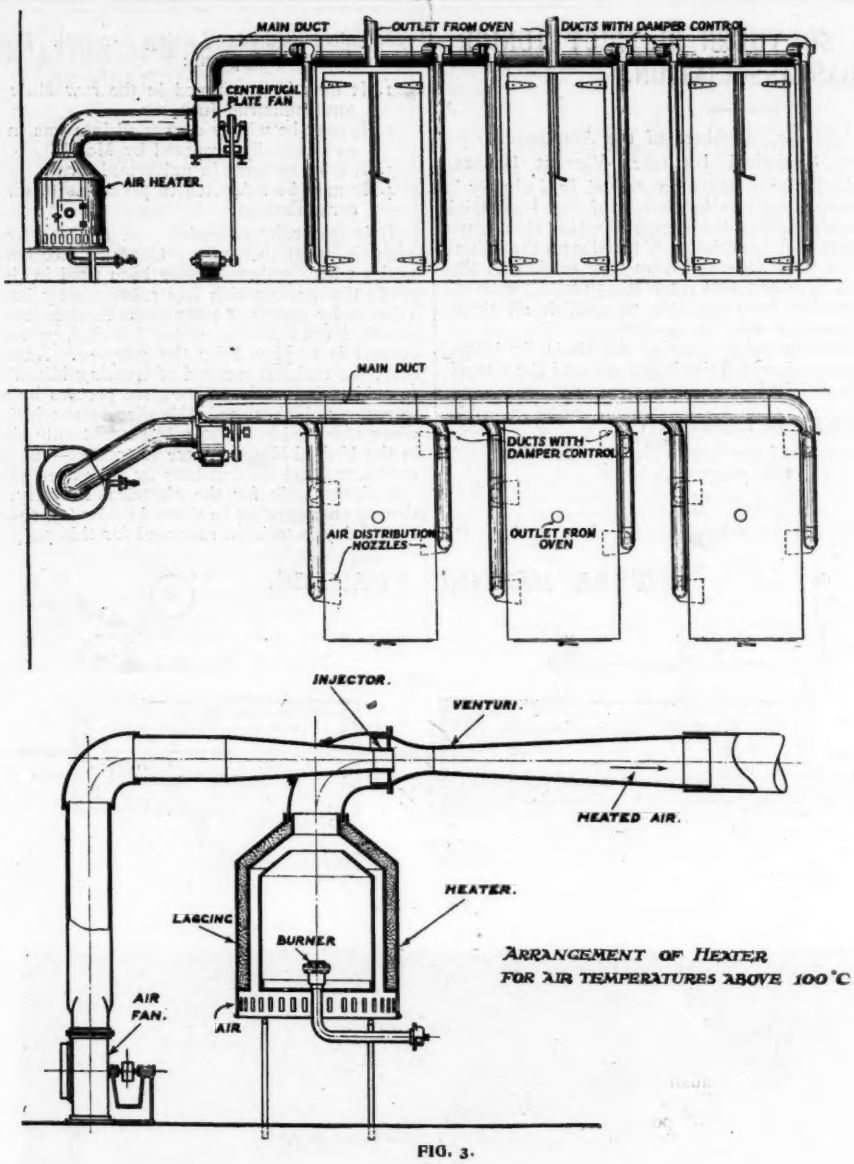


FIG. 3.

method can only be described as inefficient; since, to obtain a therm of electrical energy, 9 therms have to be sacrificed. It is said that, though the production of electrical energy is an extravagant process, some compensation is to be found in the fact that the thermal efficiencies of electrical appliances are remarkably high. From the standpoint of coal conservation, however, little can be said in favour of this, for absolute efficiency must be based on the total heat value of the original coal. The significance of this is made clear by the fact that, while (according to Sir Robert Hadfield) the thermal efficiency of the electric furnace for melting and refining steel is in the region of 47 p.ct., not more than 4 p.ct. of the original heat energy of the coal from which the electric power was produced is actually used. The remaining 96 p.ct. has been wasted. Nearly 1 ton of coal, therefore, is required to provide the heat energy to melt 1 ton of steel, whereas not more than 600 lbs. of coal when used in the raw state are necessary. Thus a much higher absolute thermal efficiency is attainable by burning raw coal.

A comparison of the fuel required for heating 1 ton of steel to 900° C. by coal gas and electricity is given in Table 1.

TABLE I.—*Comparison for Heating 1 Ton of Steel to 900° C.*

Fuel.	Therms Used.	Efficiency. P.Ct.	Pounds of Coal Used at Station per Ton Steel Treated.
Coal gas	17·9	32·0	560 lbs.* (used at gas-works)
Electricity	10·3	54·0	851 lbs. (used at electricity works)

NOTE.—* 560 lbs. at gas-works yields 280 lbs. of coke for sale, equal to 33·4 therms. Assuming that coke-fired furnaces are only half as efficient as gas-fired furnaces, then a further 0·93 ton of steel could be heated, making a total of 1·93 tons for the expenditure of 560 lbs. coal at the gas-works, then $\frac{560}{1·93}$ gves 290 lbs. per ton used in the gas works. In addition, chemical products are recovered.

TABLE II.

ELECTRICITY PRACTICE.	GAS-WORKS PRACTICE.
302 therms per ton coal yield 27·2 therms of energy available for consumers' use.	302 therms per ton coal yield 68 therms in the form of gas. Assuming 30 p.ct. efficiency of gas engine, this gives 20·4 therms available for power purposes. In addition, there is available for steam raising at 70 p.ct. boiler efficiency: 134 therms in coke, giving 93·8 therms in steam, which give by steam engine at 20 p.ct. efficiency 18·8 therms.

NOTE.—This figure is based on 2 lbs. of coal per KW.H. The average practice for the United Kingdom is about 3½ lbs. of coal per KW.H., which reduces the 27·2 therms to 15·5 therms.

TOWN GAS IN INDUSTRY.

The fuel *par excellence* for industrial heating is gaseous, and there can be little doubt that energy in this form is destined increasingly to supersede solid fuel for a large number of purposes, because of its cleanliness, convenience, constancy of supply, and uniform quality. The use of town gas in all branches of engineering and industrial activity was largely a war-time development, and resulted from the demand for a considerable increase in output of materials of every description. It was thought in some quarters that the industrial load which had been built-up during the war would, after the Armistice, decline and be finally lost; but the advantages of the use of gas as a fuel for a hundred-and-one purposes had been conclusively demonstrated, and its future was thereby assured. Of course, it was to be expected that a sudden drop in the load would occur immediately after the cessation of fighting; but with the return of more normal conditions in industry, the temporary set-back has gradually been made good.

Ten years' experience has taught that one of the essentials for the successful advocacy of gas for industrial purposes is that this branch of business must be handled by men who possess

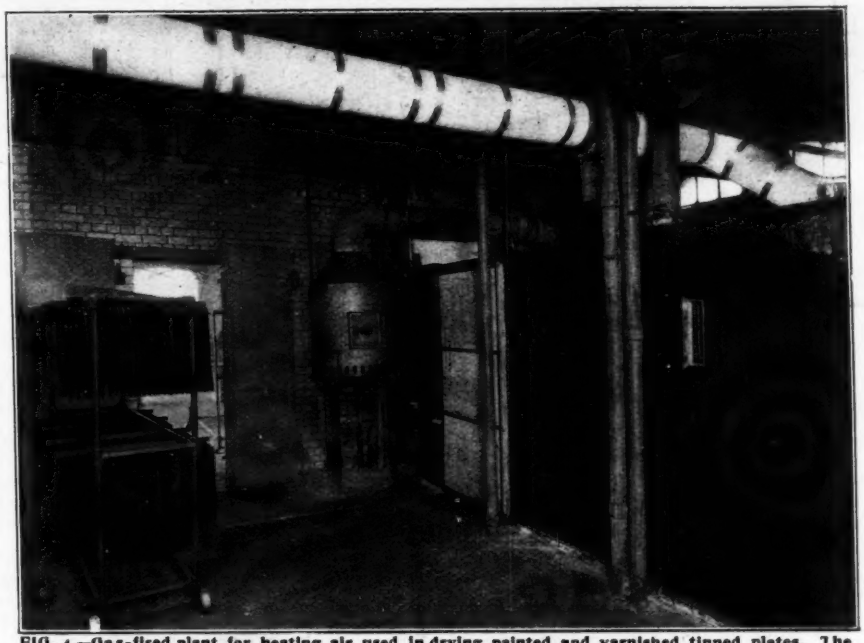


FIG. 4.—Gas-fired plant for heating air used in drying painted and varnished tinned plates. The heating ovens have a total capacity of 3000 c.ft. A volume of about 120,000 c.ft. of air is raised to about 200° Fahr. per hour; and this maintains a temperature of about 160° Fahr. in the ovens. The maximum consumption of the plant is about 3·7 therms per hour.

more than the ordinary qualifications of salesmen. This is a specialist's business, and it is hopeless to expect a healthy and progressive development if it is left in the hands of those who have but a hazy idea of the basic principles upon which the efficient use of gas as a fuel depends. There must be a common ground of understanding upon which the gas salesman and the works technologist can meet, in order that all the facts with regard to any particular problem may be properly correlated. This is only possible when the representative of a gas company possesses the requisite knowledge. A clear understanding of the basic principles of combustion and of scientific furnace control is essential. The physical and chemical properties of the various grades of fuel should be known; and such information should always be ready to hand. But in addition to an all-round technical knowledge of matters relating to fuels and their combustion, some knowledge of metallurgy and of the more common industrial processes is an invaluable asset, and may be acquired by a study of some of the hundred-and-one books at everyone's disposal to-day.

A matter of vital importance is co-ordination of effort on the part of the commercial and technical staffs. Success very largely depends upon goodwill between the commercial representative and the practical men who should be engaged in the business. The practical technician has always to remember that the man who is canvassing for gas as a fuel has, in the long run, to depend for success upon the gas-consuming appliances which are at his disposal. The real crux of the problem so far as the use of gas as a fuel is concerned is cost. At a time when manufacturers were pressed by the urgency of war, fuel costs became a secondary matter—the problem was simply a question of output. To-day, however, industry is on a strictly competitive basis, and fuel cost is of vital importance, and a question of greatest concern to gas furnace designers. It is incumbent upon the gas furnace and appliance engineer to give the strictest attention to such matters as the combustion efficiencies of the various methods of burning gas and the relative merits of the alternative systems available, the judicious selection of which when applied to a particular process may have a considerable bearing on fuel cost. One of the chief factors requiring consideration in what might be called scientific furnace design is the proportion of air to combustible gas. The fuel losses due to excess air may be considerable. Much can be done to effect a substantial economy by detailed attention to this important matter. It is surprising the extent to which heat energy is dissipated from the average gas fuel furnace. There is, however, no reason for a continuance of this state of affairs. There are many excellent insulating materials at our disposal, the use of which will go far to reduce the consumption of fuel. I have seen gas-fired furnaces concerning which one might be pardoned for assuming that they had been constructed for the purpose of performing the function of a domestic gas radiator, so effective were they in warming the room. As a result of tests carried out on lagged and unlagged muffle furnaces, it was found that, after the gas had been turned off for a period of eight hours, the temperature inside the muffle with lagging was 480° C., inside that without lagging only 250° C.

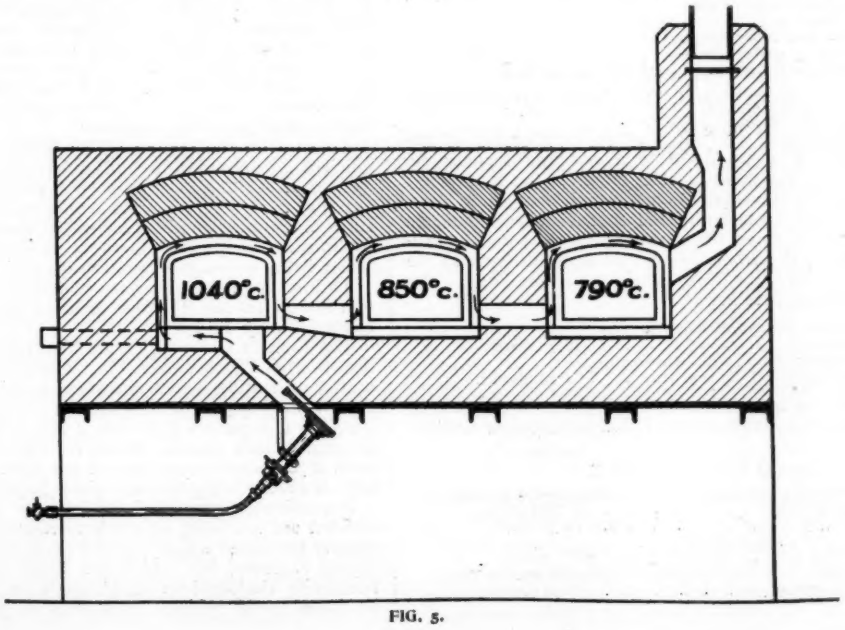


FIG. 5.

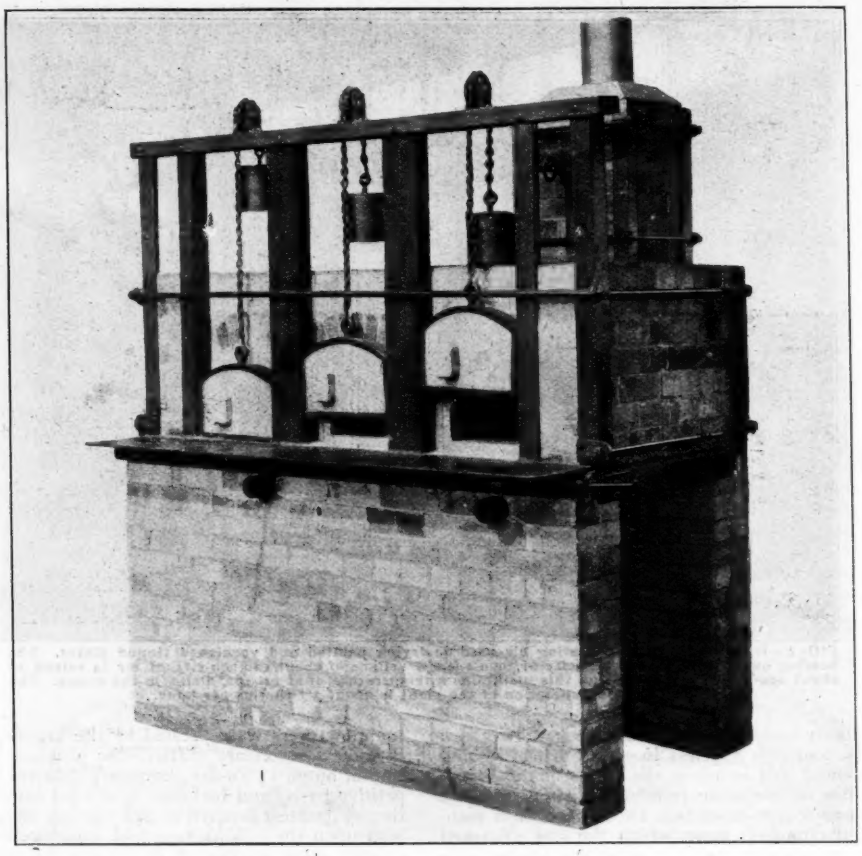


FIG. 6.

Then there are the heat losses due to the temperature at which the flue gases are discharged into the chimney. Very considerable economy may be effected by the employment of some suitable system of heat regeneration or recuperation, by means of which a proportion of the sensible heat of the so-called waste gases (really heat-wasting gases) is transferred to the air which is used for combustion. As an example of the economy which may be obtained, we may take the case of a furnace in which the air entering in sufficient quantity to effect complete combustion of the gas is raised in temperature to 1000° C. It will then have had imparted to it about 35 p.ct. of the total heat units of combustion of the gas. The value of recuperation in practice may be illustrated by the following data, which relate to a specially designed gas-fired muffle furnace for firing vitreous enamelled goods:

Inside dimensions of muffle	63 in. by 30 in. by 21 in.
Temperature of air leaving recuperator and entering combustion chamber	350° C.
Temperature of flue gases leaving recuperator	375° C.
Approximate gas consumption to maintain a working temperature of 950° C.	3·65 therms per hour.

A similar furnace in every respect, but without recuperator, required approximately 20 p.ct. more gas.

A striking example of the value of the application of the Siemens principle of regeneration to a gas-fired furnace designed for the heat treatment of steel billets is the following: The furnace was a "Revergen" open-hearth oven, 4 ft. 6 in. by 3 ft. by 2 ft., and the test required that the oven should be brought to a predetermined temperature (820° C.) and loaded-up with cold billets; the whole being then brought back to the same temperature and being so maintained for one hour. The following results were obtained:

Gas consumption per ton of billets to raise charge to 820° C.	16·3 therms.
Gas consumption per ton of billets to maintain charge at 820° C. for one hour	4·28 therms.

As compared with the results of an identical test in the case of a furnace without regeneration, the following efficiencies were recorded:

Raising Charge to 820° C.

Furnace.	Consumption per Ton.
Without regeneration	31·36 therms.
With ,,	16·30 ,,

Maintaining Charge at 820° C. for One Hour.

Furnace.	Consumption per Ton.
Without regeneration	6·70 therms.
With ,,	4·28 ,,

Inclusive Calculation per Ton of Billets Heated.

Furnace.	Gas Consumption to Raise Charge to 820° C.	Gas Consumption to Maintain Charge at 820° C. for One Hour.	Total for Operation.
Without regeneration	31·36 therms	6·70 therms	38·06 therms
With ,,	16·30 ,,	4·28 ,,	20·58 ,,

In the matter of regeneration, an interesting development in America is the employment of steel tubes which are specially treated by a process known as "calorizing." It is claimed that the treated tubes are preserved for a very long period from the destructive effects of the hot waste gases. The "Calco" system would seem capable of wide application, and should be watched with interest by those concerned with the heating of industrial furnaces with town gas. Of course, we are faced with the problem of the increased capital outlay which the employment of a system of recuperation entails; but there is little question that such additional cost is amply justified in numerous instances. It must be said that the application of such a system has its limitations—for instance, it is generally of little value for intermittent furnace work, and for very small furnaces it is not to be recommended except where extremely high temperatures are required.

To sum up the factors which require detailed attention for efficient furnace design and construction, these are: Correct system of burning gas; proportion of air to combustible gases; external radiation; terminal temperature of flue gas; temperatures of combustion and process; radiation and heat absorption by furnace body; and methods, where practicable, of using waste heat, which is often carried away by hot furnace gases.

To instance the advantages which may be gained by a study of the best means to adopt in using gas for fuel, two typical examples may be cited.

The London County Council Tramway Department required the South Metropolitan Gas Company to investigate the matter of heating steel tram-wheel tyres, as it was thought that the gas-fired system in use was not of the best. Experiments at the Gas Company's Laboratory resulted in the application of an entirely new system, which reduced the consumption of gas from 0·70 therm to 0·20 therm per tyre. A section of the furnace is shown in fig. 1 and a photograph in fig. 2.

The following example is an instance where the improvement effected did not refer so much to reduction in fuel, but to the greatly enhanced quality of the product. A series of so-called drying cabinets, but which are really hot chambers used for hardening the paint on tin plates, were internally fired by gas by means of bar burners situated in the bottom of each cabinet.

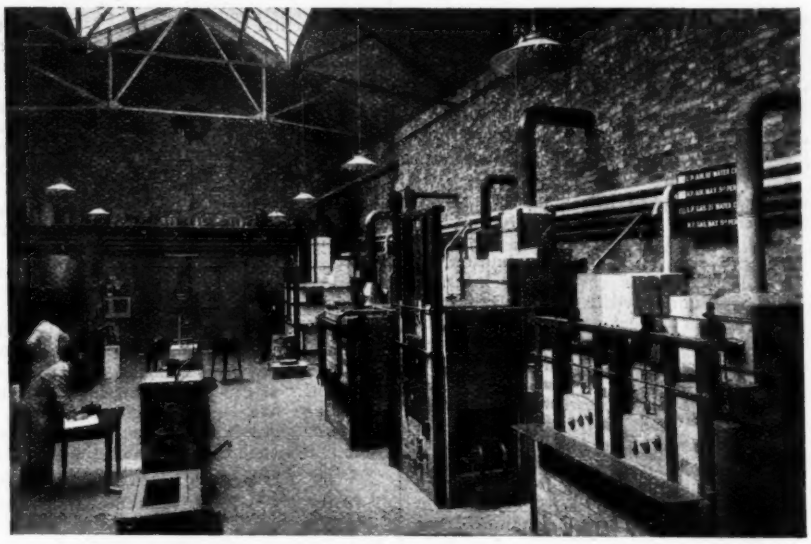


FIG. 7.—A view of the Industrial Demonstration Laboratory of the South Metropolitan Gas Company for the purposes of investigating and demonstrating the suitability of gas for industrial heating, and for affording opportunities enabling potential customers to examine the possibilities of gas for meeting their individual requirements.

The fault with the system was unequal treatment of plates, owing to bad distribution of heat. The problem was investigated, and as a result the system shown in fig. 3 and illustrated in fig. 4 was adopted, by means of which uniform and regular heating is now assured.

A very simple and efficient method of furnace construction is shown in fig. 5. A furnace of this type is suitable for operations in which graded or stage heating is required. Fig. 6 is a photograph of a furnace of this description.

Numerous other examples might be recorded, but these must suffice to illustrate the necessity for giving detailed consideration to every problem where improvements are possible. In order that the campaign against the wasteful methods of using the nation's coal which are in operation to-day may be successfully waged, the gas industry must enlist the services of the right type of men to deal with it. Experience has shown the necessity for a fuel technology department, capable of dealing with the hundred-and-one heat treatment processes met with to-day. In numerous instances the South Metropolitan Gas Company have achieved success in this matter solely by experimental research in their laboratories, which has resulted in the elucidation and the correct principles of design and construction of gas-fired appliances. Finally, collaboration of the salesman, chemist, physicist, and the practical designer is essential to progress in the utilization of both coke and town gas in the industry.

I am indebted to Dr. Carpenter for permission to use the information and data contained in this paper. My thanks are also due to the staff of the Physical Laboratory for their assistance in its preparation.

Discussion.

The CHAIRMAN said they would all agree that the paper had covered a very wide field. Most of the statements made were actual facts which left no room for criticism. If gas was to be successfully employed as an industrial fuel, it was necessary to pay strict attention to the points indicated by Mr. Chandler—such as the reduction of losses due to radiation, conduction, and sensible heat in the waste gases from furnaces. These points, it must be confessed, had up till recently been honoured more in the breach than in the observance.

Mr. S. B. CHANDLER (Tottenham District Light, Heat, and Power Company) thanked the author for the valuable data contained in his paper, which would, he said, add lustre to the Transactions of their Association. Speaking as one who had a great deal to do with the industrial applications of gas, he would stress the importance of co-operation between, and co-ordination of, the technical and commercial staffs of gas undertakings. The day when the gas engineer undertook all branches of gas-works practice was past; and the necessity for employing specialists was now recognized.

Mr. W. L. WESTBROOK (North Middlesex Gas Company) asked the author for further details of the calorizing process, in particular the use of calorized steel for grill plates, &c. It was, of course, impossible to glean from books knowledge which actual experience with plant yielded.

Mr. W. T. KENSHOLE (Lea Bridge District Gas Company) said the Association were greatly indebted to Mr. Chandler for his excellent paper. Having developed the industrial load, it was most important to ensure a supply of gas of constant calorific value and composition and at a satisfactory and unvarying pressure. With regard to the preheating of the gases, was a limit imposed by the ability of the furnace lining to withstand very high temperatures?

Mr. A. BROADBENT (Hon. Treasurer of the Association), referring to the utilization of coke for steam generation, said that two or three years ago Mr. Hugh Seabrook had given them a paper in which he pointed to the need for co-ordinating the gas and electricity industries. Had anything materialized in the meantime?

Mr. J. G. JOYCE (Gas Light and Coke Company) asked what type of air and gas controller was used in the metal-melting furnaces illustrated in the paper.

Mr. CHANDLER, replying to the discussion, said that as a result of investigating the calorizing process, he was very favourably impressed by its possibilities. It was being used extensively and increasingly in America, and he thought there was a big future for it in this country. Several gas companies in and around London were being supplied with calorized gas grillers, which were giving every satisfaction.

At this stage Mr. Chandler exhibited some ordinary cast-iron and wrought-iron regenerator tubes which had been heated to 1000° C. for 16 hours. By contrast he showed a calorized tube which had been subjected to the same temperature for 96 hours. Whereas the latter was unaffected, the cast-iron and wrought-iron tubes had very considerably deteriorated.

He would mention that Messrs. Hadfield had brought out a new material in competition with nickel-chromium, which promised to be of great service to heating engineers. This new material had, without deteriorating, withstood a temperature of 1000° C. for 128 hours, and the same temperature in an open coke furnace for 36 hours. Nickel-chromium alloy withstood such conditions, but, generally speaking, its cost was too high for general use. The new material could be produced at a little over half the price, and calorized tubing cost much less than this. He was in entire agreement with Mr. Kenshole regarding the need for a constant quality and pressure of gas. The South Metropolitan Gas Company had always stressed this point. As to the temperature to which furnace linings could be subjected, there were materials available which were suitable for almost any temperature—certainly up to 1700° C. It was all a question of cost. Mr. Broadbent had referred to the use of coke for steam generation. After the war the London County Council generating station at Greenwich employed a mixture of small coal and coke breeze, burning this by the "Sandwich" system introduced by Mr. Nicol. This proved highly satisfactory. About 40,000 tons of coke breeze were used, and a saving of £8000 was effected as the result of a year's working. What could be done at a large station could be accomplished at the smaller ones. In reply to the question asked by Mr. Joyce, the controllers used were made by Messrs. James Keith and Blackman Co., Ltd.; and these had given every satisfaction. Indeed, their installation had enabled them to compete with foundry-coke costs. For a particular installation, the cost of coke was £513 for twelve months. After replacing by gas-fired furnaces, a saving of £83 was made during a similar period. His experience in South London had taught him that an important factor essential for the successful application of gas to industry was good service. Every gas-fired installation should be inspected periodically, to ensure the consumer's satisfaction. All consumers should be made to understand that the services of the gas undertakings were at their immediate disposal.

Mr. A. TENNANT (Croydon Gas Company), in proposing a vote of thanks to Mr. Chandler, said that, in view of the attention which was being given—both generally and officially—to the questions of coal conservation and smoke abatement, the time was opportune for emphasizing the benefits accruing from the use of gas as an industrial fuel.

Mr. J. R. GALE (North Middlesex Gas Company) seconded the vote.

Mr. LEONARD LACEY (Hon. Secretary) announced that the summer meeting of the Association had been postponed till June 20.

National Gas Council.—The seventh annual general meeting of the Council is to be held on Tuesday, May 26, at 11.30 a.m.

Wales and Monmouthshire Junior Gas Association.—The third annual general meeting of the Association will be held at Newport, Mon., on Saturday, May 2.

EVOLUTION OF THE VERTICAL RETORT.

Mr. Walter T. Dunn, before the Junior Institution of Engineers.

For a long time, in years gone by, Mr. Walter T. Dunn, M.Inst.Mech.E., occupied the position of Secretary of the Junior Institution of Engineers, of which he later on became Chairman; and last Friday evening he once more did good service to the members, by presenting to them a paper on "Vertical Retorts," which was crammed full of useful information.

Mr. Dunn, during nearly thirty years spent as Secretary of the Institution of Gas Engineers, has, of course, had unique opportunity for the assimilation of gas engineering information; and of his store, he gave unreservedly to his brethren of the "Juniors." To deal with his subject as thoroughly as the author had determined to do necessitated a very lengthy paper indeed; and it was illustrated by a profusion of models, lantern slides, and diagrams, for the loan of which due acknowledgment was made to the Vertical Gas Retort Syndicate, Sir Arthur Duckham, K.C.B., the Woodall-Duckham Company, West's Gas Improvement Company, Mr. Alexander Wilson, M.Inst.C.E., and Messrs. Robert Dempster & Sons. With the author, we entertain no doubt that his colleagues in the Junior Institution shared his admiration of the splendid progressive work of the gas engineer and gas plant manufacturer in the excellent vertical carbonizing systems which he described, but which are, after all, only a part of the complete story of gas engineering; and that they were in full agreement with his claim that in no other branch of engineering is a deeper knowledge of physics, chemistry, and pure civil engineering demanded—knowledge that implies the ability to "direct the great sources of power in Nature for the use and convenience of man." It should here be said that the value of the paper was greatly enhanced by a visit on the following day—which had been arranged by permission of Mr. Thomas Hardie, the Chief Engineer to the Gas Light and Coke Company—to the Fulham Gas-Works, to see a 7 million c.ft. a day Glover-West vertical retort installation at an interesting stage of its erection. Previously the Institution had visited the works of the Tottenham District Light, Heat, and Power Company, where a 6 million c.ft. a day Woodall-Duckham installation was inspected in operation.

The subject was divided chronologically, by description or by illustrations, into nine sections, according to the dates of the introduction of the various systems. The sections were: Scottish Shale Oil (William Young)—1868 and 1872; Settle-Padfield—June 2, 1902; Dessau Intermittent (Dr. Bueb)—July 7, 1902, and 1904; Woodall-Duckham—July 27, 1903; Young and Glover—Nov. 17, 1905; Glover-West—Oct. 4, 1906; Glasgow (Alex. Wilson)—1911; Dempster-Toogood—1912; and Dessau Intermittent Chamber Ovens—1916.

Scottish Shale Oil Retorts.

Mr. Dunn had been fortunate enough to have lent him for the purpose of illustrating the shale oil retorts copies of a set of five working drawings of the Pumpherston patent retort for the Commonwealth Oil Corporation, Ltd., of Mid-Calder, as well as copies of two drawings of Mr. William Young's plant which was in operation at the oil refinery under his supervision. In 1874, Mr. Andrew Scott, of Musselburgh, introduced a vertical gas retort system which comprised a setting of four cast-iron (afterwards firebrick) retorts, each of 12 cwt. coal capacity.* This form of retort was suitable for the carbonization of shales. Steam was admitted into the lower portion of the retort for the production of water gas.

Mr. W. R. Herring, at one time Chief Engineer to the Edinburgh Corporation Gas Department, invented a vertical gas retort setting which was based on the Pumpherston shale oil retort. It was described and illustrated in the "Journal" for Jan. 16, 1906. Drawings exhibited illustrating Young's patent improved retort bench were of interest from the fact that the design of the first installation of Glover-West retorts (erected at St. Helens) was planned with them in view. In 1828 John Brunton patented an intermittent system for the carbonization of coal in vertical retorts. They were filled with coal, and the gas was given off at the top. Rowan, in 1855, patented a system in which the coke was discharged into a water bosh and then raked out from it by hand.

Settle-Padfield.

The late Mr. William Padfield, when Engineer at the Exeter Gas-Works, and his Assistant the late Mr. Thomas Settle, did important work in experimenting with vertical retorts and developing the system which bears their names. Their retort was intermediate between a continuous and an intermittent system. Coal was fed continuously into the retort, but the coke was discharged by hand at intervals—the retort being kept about half empty. In its design, the retort commenced in a vertical plane, but turned off at an angle at the base, so that the coke was discharged through the side of the bench, and not at the bottom.

Dessau Intermittent.

This system of verticals was the outcome of several years' experimental work by Dr. J. Bueb; the first setting being erected at Dessau by the German Continental Gas Association. The system was introduced into England by the Vertical Gas Retort Syndicate, Ltd.; and there are notable examples of it at Sunderland, East Hull, and Melbourne (Australia). A setting may comprise various numbers of retorts, 4 or 5 metres long, arranged in rows of two or three. In the latter type, three retorts are controlled by one operation. The producer is placed alongside the retorts, and the regenerative flues on either side. The coal is fed into a charging hopper; and a measured quantity, with a small amount of breeze, is dropped into the retort, and the lid closed. The coke discharging door at the bottom is opened by means of a lever; hydraulic power being employed for operating it.

Mr. Dru Drury (the Gas Engineer at Sunderland) states that the period of carbonization of the charge may be varied to suit differing conditions; but a twelve-hour charge, including two hours of gentle steaming, has been adopted there. At the gas-works at East Hull, under the direction of Mr. R. Nelson, there are five beds of eighteen retorts, each worked in two shifts of eight hours per 24 hours; there being two periods of four hours each during which the bench is left unattended.

Woodall-Duckham.

In the process of invention of the Woodall-Duckham system, said Mr. Dunn, the truly British qualities of pluck, patience, and perseverance were strikingly displayed. Mr. H. W. Woodall (now Lt.-Col. Woodall, C.I.E.), son of the late Sir Corbet Woodall, D.Sc., when Engineer at the Bournemouth Gas and Water Works, had as his Assistants Mr. (now Sir) Arthur Duckham and Mr. H. C. Head, M.Inst.C.E., who is at present Engineer to the Winchester Gas and Water Works; and this trio of young gas engineering enthusiasts worked persistently at Bournemouth on the difficult problem of carbonization in vertical retorts. Their experiences are fully recorded in a paper by Lt.-Col. Woodall which he read before the Institution of Gas Engineers in 1908. After trials with several experimental settings, it was arranged that Mr. Duckham should resign his position of Assistant Engineer to the Bournemouth Gas and Water Company, and devote all his time to the problem of continuous carbonization. Designs were prepared for new plant, and on inspecting these the Directors at Bournemouth decided to erect a bench comprising four settings, each of four retorts, at their Bourne Valley Works. About this time, Mr. Thomas Goulden, of the Gas Light and Coke Company, and Mr. Edward Allen, of the Liverpool United Gas Light Company, reported favourably on the system to their respective Boards; and both Companies decided to erect installations, each of two settings of four retorts. The plant at Bourne Valley was started-up in January, 1907.

In the Woodall-Duckham system there are three standard sizes of retorts, having throughputs of approximately 3, 5, and 7 tons of coal a day respectively. They are 25 to 26 ft. in length, and of rectangular tapered section; the three sizes varying in the dimensions of the major axis—the minor axis remaining the same in all cases. The taper in the length is not continuous from top to bottom. Most of the taper is confined to the upper 10 ft., where the maximum swelling of the coal takes place. Two-stage heating is effected, thus allowing of efficient zoning of the heats in accordance with the requirements of the various coals.

Among the slides shown were the Glasgow plant of 21 million c.ft. per diem (1356 tons of coal), the largest continuous vertical retort installation in the world; and the installation at Innerleithen of 130,000 c.ft. daily capacity (7 tons of coal), which can be worked at 3 tons a day, and is the smallest Woodall-Duckham installation in Great Britain.

Steam is admitted at the coke extractor, and is superheated in cooling the coke.

Young and Glover.

Mr. William Young, of Peebles, and Mr. Samuel Glover, Engineer to the St. Helens Corporation Gas Department, designed a vertical retort setting which was patented on Nov. 17, 1905. An illustration of it will be found in the "Journal" for June 19, 1906 (p. 758). It was founded, in constructional details, on the Scottish shale retorts; but the discharge of coke did not govern the coal feed. The retort was not filled; but it was intended to keep the coal at a constant level, the space above the charge forming a radiant heat chamber for the dissociation of the tarry vapours. The gas also passed through the coal-feeding hopper before leaving the retort. In 1909 Mr. Glover and the late Mr. John West departed from this system, and reverted to that of governing the coal feed by the rate of coke discharge.

Glover-West.

The first Glover-West installation at the St. Helens Gas-Works consisted of eight retorts, each 20 ft. 9 in. long, which were put into operation in 1908, and remained at work until 1915, when they were taken out and replaced by four retorts of a special design. In these eight original retorts a great many varieties of coal from all parts of the world were carbonized under test conditions. The setting embodied all the principles which are still the fundamental idea of the Glover-West vertical retort setting. The retorts were heated by producer gas

* "King's Treatise on Coal Gas," Vol. I., p. 235.

consumed in horizontal chambers superimposed one above the other in the height of the retort, so enabling the temperature to be varied at will throughout the length of the retort. Incoming coal was heated by waste products circulated in the top chambers, and heat was transferred from the outgoing coke to the secondary air circulated in the bottom chambers.

The second installation consisted of sixteen retorts erected at the Droylsden Works of the Manchester Corporation, to the order of the late Mr. J. G. Newbigging; and the results of severe tests were given in a paper on "The Scientific Carbonization of Coal," which Mr. Newbigging read before the Institution of Gas Engineers at their Glasgow meeting in 1911. In this case 2 ft. 3 in. was added to the length of the retort, and the shape was altered to an increasing but changing ellipse, which began at the top with straight sides and semi-circular ends 30 in. by 10 in., finishing in an ellipse at the bottom 36 in. by 22 in. This increased the capacity from the original 2 tons to 2½ tons a day. The retorts remained, with minor repairs, in operation from 1910 to 1921, when they were re-built, with certain modifications. Mr. W. Buckley published the results of the eleven years' working in a paper on "The Maintenance Costs of Continuous Vertical Retorts," which he read in May, 1923, before the Manchester District Institution of Gas Engineers.

Other installations followed rapidly, and some of those involving modifications in one form or another were described by Mr. Dunn, and illustrated by slides. By 1918 the experience with the Droylsden elliptical retort had become sufficiently lengthy and full to show that, not only was the elliptical shape correct, but that it must be developed in a particular way. An ellipse which in the descent of the retort involved a rapid change in the shape of the major sides gave rise to spaces left between the charge and the retort wall, with consequent inconveniences. These were avoided by constructing the retort with a constant curvature in the major sides; and the standard shape was fixed on the firm foundation of experience and established fact. The new design was introduced simultaneously at Stafford and Montreal. The retort was 33 in. by 10 in. over the major and minor axes respectively at the top, and it increased at a constant angle to 39 in. by 18½ in. over the length of 21 ft.

The demand of the country for fuel oils during the war led Mr. John West to undertake at St. Helens experiments in steaming the charge, which has since become the generally adopted practice in the operation of continuous vertical retorts. So far as the results concerned the production of fuel oils, and the establishment of the practice of steaming, they were published by Mr. West in a paper which he read in November, 1917, before the Southern Association of Gas Engineers and Managers. The St. Helens Gas Committee were so far convinced of the practicability of the 40 in. retort that it was adopted in the third vertical retort installation, consisting of 48 retorts, with an estimated capacity of 2 million c.ft. of gas a day, erected there in 1921.

In 1920, the "New Model" retort was patented. This was nothing more than the 33 in. by 10 in. retort 21 ft. long extended to 25 ft. by the addition of a so-called "steaming chamber" at the base. The function of this chamber was to provide a zone in which the hot coke would be available for the purpose of raising the temperature of the steam to that of dissociation before it reached the retort proper, thus securing the advantages of steaming without deducting from the heat necessary for dry distillation in the retort itself. The immediate effect of this development was that the retort was proved to be capable of carbonizing 50 p.ct. more coal per day, and producing from 50 to 100 p.ct. more gas; and this increase of capacity was obtained at a trifling increase in first cost per retort. The economic effect was that the capital cost of the Glover-West system per unit volume of gas produced was reduced to the pre-war level. The extension of the new principle to the 40 in. retort was the most natural direction for the next and last step in the development of the Glover-West vertical retort. That this design of retort has proved satisfactory is shown by the fact that it has been adopted by the Gas Light and Coke Company for their Nine Elms Installation.

Glasgow System.

The Glasgow system of continuous-intermittent—continuous as regards production of gas, and intermittent in relation to the processes of drawing and charging—vertical retorts, the invention in 1911 of Mr. Alexander Wilson (then Chief Engineer and General Manager of the Glasgow Corporation Gas Department) was introduced specially to deal with the hard non-caking Scotch coal used by that undertaking. Neither the intermittent nor the continuous system appeared fully to meet the requirements of the situation. A trial setting of four retorts was in operation at the time of the 1911 meeting in Glasgow of the Institution of Gas Engineers, during Mr. Wilson's presidency. Various improvements were afterwards made; the setting giving encouraging results from the commencement.

With this system no constantly moving machinery is required; and the coke is cooled in bottom cast-iron chambers, to which are attached movable buckets for holding the water seals. These buckets are actuated by a small hydraulic ram. The retorts are heated in a simple manner; the producer being carried to the top of the setting. Fuel gas and secondary air are admitted between each of the top sections of the retorts, in parallel streams, so that little mixing takes place in the top section. The mixing of the gas and air, with the consequent combustion, takes place in the second section; the temperatures becoming gradually reduced in the downward travel of the gases.

Results obtained from the trial setting justified the decision to erect at Glasgow a 4 to 5 million c.ft. per diem installation on the site of a 2 million c.ft. section of horizontal retorts which were worn out and required complete renewal.

Dessau Intermittent Vertical Chamber Ovens.

This system is a development of the former Dessau intermittent vertical retort, and its construction in this country is in the hands of the Woodall-Duckham Company. The capacity of a plant now in course of erection, and having 25 chambers at 2¼ tons per charge per chamber, will be 112½ tons a day. This should make about 7800 therms a day, equivalent to some 1¼ million c.ft. The advantages claimed for the intermittent vertical chamber oven are the high rate of therm production per square foot of ground area; steaming can be carried out to an extent which is not possible with the horizontal system; low labour costs; absence of machinery, since charging and discharging are performed by the force of gravity; bulk quenching, resulting in a low moisture content in the quenched coke; absence of heat from the space in the chambers, producing superior qualities of tar and ammonia, and a higher quality gas; fewer occasions as compared with horizontal retorts for discharging coke, and consequent reduction of attendant losses. As each chamber is entirely separate, neighbouring chambers are not affected when being charged or discharged. The intermittent vertical chamber has been successfully operated with all classes of coal. With the use of best silica material for the chamber walls, there can be no sticking of charges. The adoption of the big-chamber is better from this point of view than the old type of small Dessau retorts.

In closing, Mr. Dunn emphasized the great importance of the waste-heat boiler in connection with vertical retort installations, and referred the members to the paper read in November, 1923, before the Southern Association of Gas Engineers and Managers, by Mr. J. S. Thorman (Engineer of the Stratford Station of the Gas Light and Coke Company), entitled "Waste Heat and Its Insulation from Glover-West Verticals and other Carbonizing Plant."

Appreciative Remarks.

At the conclusion of the paper—the reading of which had, from considerations of time, to be somewhat curtailed—a number of questions were asked, and numerous indeed were the expressions of gratitude to Mr. Dunn for the great trouble to which he had gone in its preparation, as well as of congratulation upon the excellent results of his work. The Chairman (Mr. Edgar) said that Mr. Dunn had always taken a keen interest in the Institution, and it was greatly owing to his efforts that it had attained its present strong position.

Those taking part in the discussion included Mr. Gardner, of the Wandsworth Gas Company; Dr. E. W. Smith, of the Woodall-Duckham Company; Mr. R. J. H. Sayers, of West's Gas Improvement Company; and Mr. George Evetts—who pointed out that the vertical retort permitted the force of gravity to be used, once the coal had been got into the first required position, and, in addition to this, the plant itself was remarkably flexible. He agreed with Mr. Gardner in his contention that the horizontal retort was "not dead yet."

Dr. Smith explained that the resuscitation of the intermittent system was to meet the case of some districts where there was a demand for much denser coke than was made in the continuous vertical retort. Such coke could be produced in the intermittent retort, and gas made from the installation at approximately the same price per therm as with the continuous retort. The author had dealt in a most tactful and delicate way with the various competitive systems. He advanced an earnest plea for co-ordination in dealing with the vital fuel problem of the country.

Mr. Sayers, adding his meed of praise to the author, remarked that the paper contained a very complete history of the development of the vertical retort. He enumerated the main advantages of vertical retorts, and pointed out that provision was made for regulating the throughput so as to meet the carbonizing requirements of different kinds of coal. Extensive investigation had shown that there should be no difficulty whatever in carbonizing any class of coals—including such as were supposed to be "sticky," like Durham coal. At a great many works on the Continent, Durham coal was carbonized both in Woodall-Duckham and Glover-West retorts; and he did not think that in any of these works they would care to revert to the horizontal system. In addition to their other advantages, vertical retorts made a strong appeal to gas engineers from a coal conservation point of view.

In his acknowledgment of the many kind things that had been said, Mr. Dunn assured the members that he would always be ready to do anything in his power to assist an organization so near to his heart as was the Junior Institution of Engineers.

THE AUCKLAND AND DEVONPORT (N.Z.) GAS-WORKS.

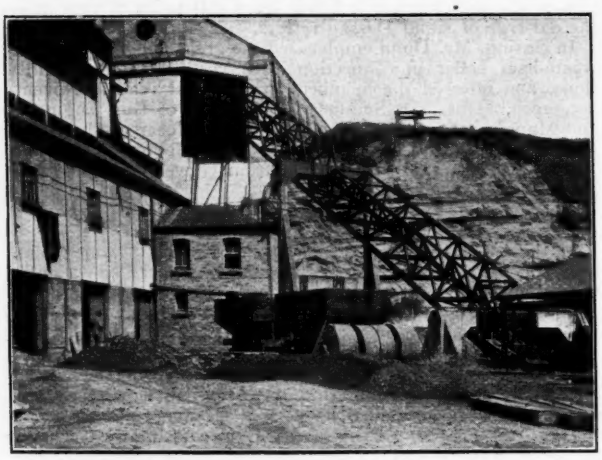
The following brief description is taken from the Presidential Address of Mr. James Lowe, M.Inst.C.E., at the First Annual Meeting of the Gas Institute of New Zealand, which was held in February.

Auckland Works.

Gas was first supplied from the present manufacturing station at Beaumont Street in April, 1904. Prior to that date the old works at Nelson Street (shortly afterwards closed) had been the scene of manufacturing operations, since the start of the Company. The total area of the present site is a little over 14 acres; and on it the whole of the manufacturing plant, with the exception of the gasholders, is accommodated.

There are two gasholder sites, one of 1¾ acres at Freemans Bay, close to the works, where there are two 2-lift holders of 500,000 and 1,000,000 c.ft. capacity respectively; and the other of 3½ acres at Beresford Street, about three-quarters of a mile from the works, where there is one 3-lift holder of 2,300,000 c.ft. capacity, and room for another of considerably larger size.

The site of the manufacturing station at Beaumont Street was originally on the side of a hill; the frontage at Beaumont Street being at sea-level, and about one-half of the area being 60 to 70 ft. high. It was originally intended to excavate the whole of this area to the level of Beaumont Street, but this intention was changed at a later date; and the top of the cliff was set aside for purifiers and extensions to them, tar and liquor storage plant, station meters, sulphate, anhydrous ammonia, and tar plants, &c. The frontage to Beaumont Street has been excavated as a site for retort houses and No. 1 coal store, workshops, offices, coke yard, &c.; and the boiler house,



Inclined Portion of Rope-Driven Suspension Railway.

engine room, scrubbers, washers, and condensers have been placed on a bank 12 ft. above yard-level.

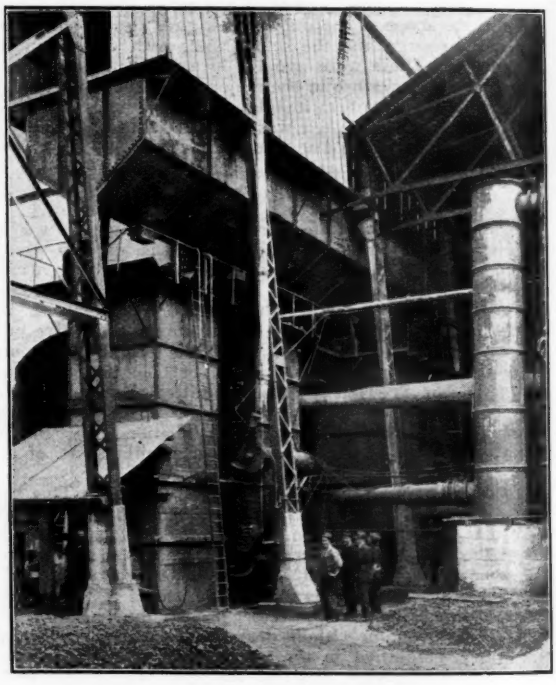
No. 2 coal store has been carved out of the cliff at its northern end. This store is 174 ft. broad by 240 ft. long. It is made in four sections, each of which is built above a tunnel 240 ft. long driven into the cliff at right angles to Beaumont Street. The tunnels have been built to contain conveyors; and a "Marcus" conveyor is at work in one of them. Each section of the coal store forms a hopper, and the coal gravitates through revolving drums from the store on to the conveyor. The revolving drums are mechanically driven, and their speed can be varied so that the mixture of coals delivered to the conveyor can be altered at will. The cliff is composed of a sedimentary rock called papa, with a 12 ft. overburden of clay; and as this rock disintegrates, or weathers, when exposed to air, the store had everywhere to be lined with concrete, and reinforced where necessary. The height of the store from the underside of the roof trusses to the top of the tunnels is 42 ft. The inclined floors are lined with concrete, 6 in. thick; and all the walls except the front wall, which has no support from the cliff, are 18 in. thick. Each section of the store will contain 4500 tons, or an average of 18,000 for the four sections, without trimming. If the top of the coal were trimmed level, this figure could be increased to 25,000 tons.

Rope-Driven Suspension Railway.

As the top of the store is about 60 ft. above yard-level, it was designed to be filled with coal by a Bleichert rope-driven suspension railway, with automatic coupling and uncoupling apparatus for the cars. The loading station is a pit in the yard, and the cars rise 68 ft. up an incline to the top of the store, and then travel round a track shaped like a gridiron, with both right and left-hand curves, and down the incline to the loading station. As the war supervened, it was not possible to make a contract with the Bleichert firm of Leipzig; and we had to design, construct, and erect the railway. Before doing this, inquiries were made from a number of British makers of coal conveying machinery; but none would undertake the work.

The ropeway has at present a total length of about 800 ft. Each car carries about one ton of coal, and the capacity of the ropeway with six ropeway cars is 75 tons per hour. When the number of cars is increased to twelve (the maximum), the capacity will be 150 tons per hour. The traction rope is of the best extra-tough cast steel, $\frac{13}{16}$ in. in diameter, with a breaking strain of about 95 tons per sq. in. It is driven by a 40-H.P. motor. This is necessary for the starting torque, but when the track is evenly occupied by cars, only 20 to 25 H.P. is required. The rails in the loading pit are laid with a slight gradient, so that one man can easily push a loaded car. On entering the loading terminal, the empty cars uncouple automatically from the traction rope, and are pushed by a workman in front of the loading chutes. The loaded cars are then pushed to the exit, at which point they grip the traction rope automatically, and are carried up the incline and round the track over the coal store, finally returning down the incline to the loading pit. When the current is switched off, the mechanism is prevented from moving by means of a solenoid brake on the driving shaft of the motor.

No. 1 coal store alongside the horizontal retort house is 250 ft. long by 70 ft. broad, with walls 30 ft. high. Its capacity is about 13,000 tons of coal, and it is filled by a gravity-bucket conveyor of a capacity of 50 tons per hour. Coal comes into the works in steel hopper wagons of 10 to 12 tons capacity running on the Company's street railway along Beaumont Street from the Western Wharf. Larger wagons cannot be



Water Gas Plant at Auckland.

used, since the small radius of the curves (68 ft.) limits the length of the wheel base to 6 ft. 6 in. Coke-fired locomotives supply the motive power for this railway.

Carbonizing Plant at Auckland.

The present carbonizing plant at the Auckland Works consists of 23 beds each containing nine horizontal retorts 24 in. by 16 in., 20 ft. long, and seven beds each of eighteen intermittent vertical retorts 13 ft. long. The horizontal retorts are charged by De Brouwer charging and discharging machines, and the coke is removed to the yard by a De Brouwer hot coke conveyor. Sixteen of the horizontal retort beds were originally built as settings of eight's. They were later rebuilt as nine's when opportunity offered, and additional beds of nine's up to the number of 23 were built. The house is now in process of conversion to settings of twelve's. This means that the arches have to be raised 2 ft., and the stoking machinery has also to be raised.

The hot coke conveyor will be discarded, and the telpher track, which will replace the conveyor, is already in position outside the retort house.

Water Gas Plant.

Three water gas plants are in continuous use. Two of these have been installed in conjunction with the horizontal retort house, and one in conjunction with the verticals. They are automatic in action, and the blow gases are utilized to heat the coal gas retorts. The hot water gas is passed through the vertical retorts; but, when used in conjunction with horizontals,

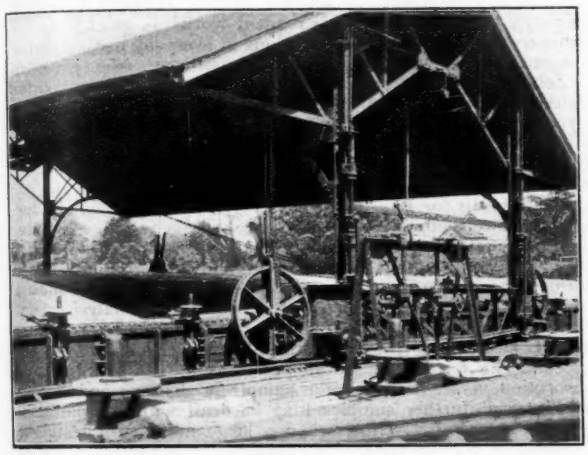
it is passed, after being partially cooled, directly into the foul main.

PURIFIERS.

The purifiers are all of the water-lute type. There are twelve altogether; the last set of four boxes being built in 1913 on the top of the cliff. The boxes of this set are 27 ft. wide by 38 ft. long by 6 ft. deep, and are built two in a piece on a ferro-concrete framework, so that the bottoms of the boxes are 14 ft. above the ground. There is no permanent roof over these boxes, but two movable gantries running on rails and carrying a roof are provided. These gantries carry rope hoists capable of movement in vertical and horizontal directions, for lifting the oxide from ground-level and depositing it at any point in the boxes. Both the rope hoists and the gantries themselves are operated by hydraulic power.

Devonport Works.

The area of the site of the Devonport Gas-Works is about six acres. The land at the northern end of the site has been reclaimed from Shoal Bay. The land on the southern end is about 50 ft. above sea-level.



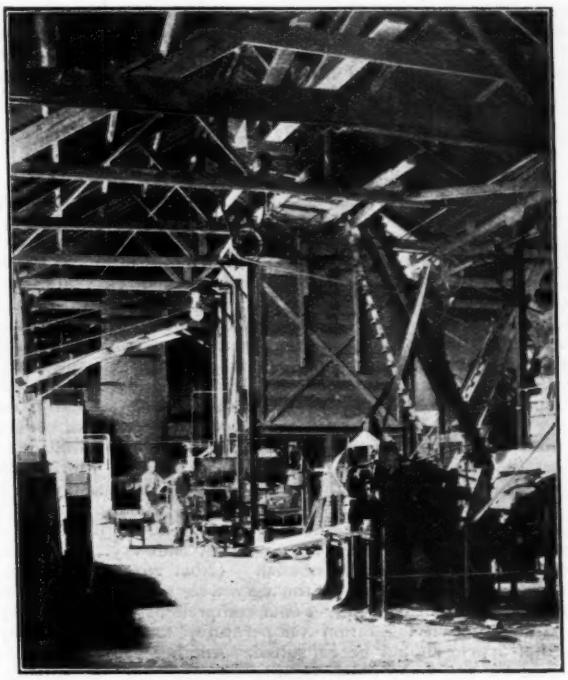
Travelling Gantry Carrying Hydraulic Hoist for Loading Purifiers with Oxide.

The coal store has been formed by excavation in this higher ground, the sides of the excavation having been trimmed to an angle of about 30°, so that the coal gravitates to a tunnel driven north and south under the coal store, where it is filled into tipping wagons which convey it to the coal breaker and elevator. The coal entering the works has to be carted, and is discharged by tipping carts or motor wagons from transverse bridges lying east and west across the store, and 21 ft. above the top of the tunnel.

The carbonizing plant consists of intermittent vertical retorts and water gas plant. The coke is removed from the retort house by hot coke tipping wagons which run under the retort bench, and are hauled up an incline by a wire rope, after being quenched outside the retort house. The breaking and screening plant and coke hoppers are at the upper end of the incline, and yard storage is obtained by tipping the wagons on the incline.

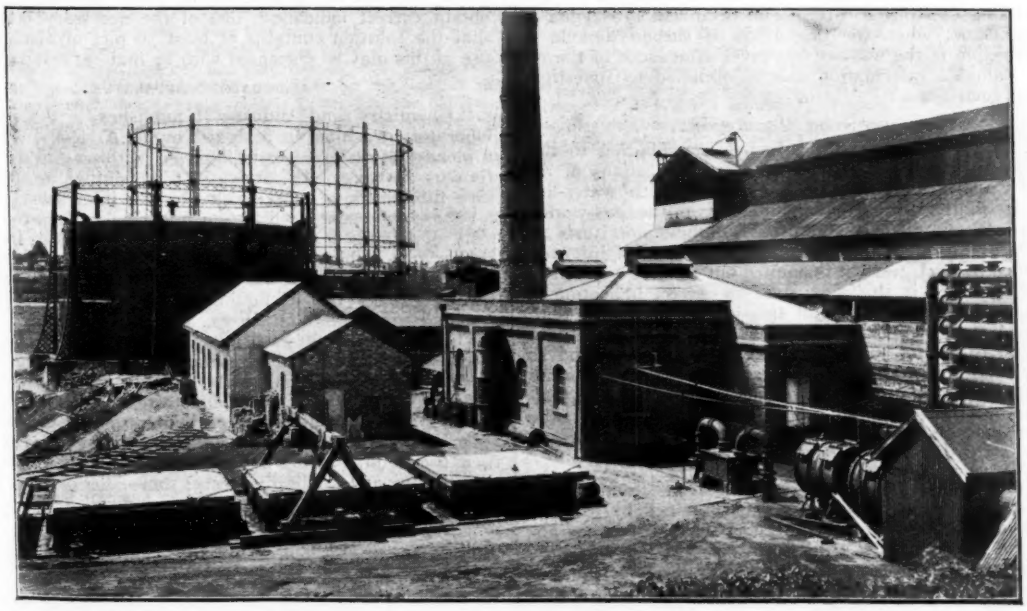
MANUFACTURE OF FIREBRICKS AND RETORTS.

The manufacture of firebricks and retorts as a branch of the Company's business was begun about the year 1884. Fireclay of excellent quality is obtainable from the neighbourhood of Whangarei; and the bricks and retorts produced are not inferior to the best which can be imported.



View Inside Firebrick Works.

The works are up to date. Advantage has been taken of the slope of the ground to terrace the site, with the object of getting some help in the transport of material by gravitation. The drying sheds are provided with steam-heated floors, and hand labour is displaced by machinery where it has been found advantageous to do so. A semi-continuous gas-fired kiln of five chambers is at work; and when the output justifies it, this kiln can have additional chambers added to it, which will make it continuous. The life of the material in the horizontal retort settings is from seven to nine years.



VIEW OF THE DEVONPORT WORKS.

CHEMICAL TOPICS FROM CURRENT LITERATURE.

Notes from Recent Technical Publications.

By H. J. Hailstone, A.M.I.Chem.E.

Steam Raising.

An excellent aid to the control of combustion in steam boilers is referred to by C. E. Wade in an article on "Economy in Steam Raising" published in "Chemistry and Industry." In order to indicate the correct adjustment of air to fuel supply on boilers using coal, a simple attachment known as Carr's combustion indicator is fitted. This consists of a steam supply taken from the boiler through a coil in one of the flues, and in this way superheated. The steam then issues through a jet and induces a stream of the flue gases with it to a discharge pipe in front of the ashpit. Deficiency of air is immediately indicated by the presence of smoke at the discharge; and this may be rectified so that only a mere trace of smoke is perceptible.

Coke—and the Competition.

Reference to previous contributions under the heading "Chemical Topics" shows that the subject of coke has always been well borne in mind; and most readers need little reminding of the enormous dimensions to which the technical literature of this subject has grown during the last ten years. Sir Arthur Ducknam's magnificent stimulus to further work, and the publication of really useful practical knowledge will, it is certain, do much towards clearing up many debatable points and establishing some definite and sound practical principles concerning the technique of economic production and handling of the grades of coke suited to the domestic and industrial requirements of this country. Every week brings fresh contributions to the study of the subject; and it is always difficult to select the most important items from a field of information having such intricate ramifications. One of the most notable of the recent contributions was Dr. Weyman's paper entitled "The Combustion of Coke in One Stage," now printed in the Transactions of the Society of Chemical Industry. This has already appeared in the "Journal" (Nov. 26, 1924, p. 570), and readers will have noted the very wide range of problems and phenomena dealt with. For a comprehensive bibliography of coke reactivity, ignition temperature, and structure the original article should be consulted. Another article of great interest on the same topic recently appeared in "Brennstoff-Chemie." Therein H. Bähr deals with some of the factors which determine the properties of coke. A knowledge of the moisture and ash content of the coal employed, together with the bitumen content and coking power, gives a basis for adjusting coking conditions. This basis may be further investigated by experimental tests at different temperatures and with different mixtures. The resulting coke may be examined for three significant properties—ignition temperature, reaction temperature, and reactivity—in one apparatus consisting of an electrically-heated quartz tube. On raising the temperature until carbon dioxide is formed in the current of air passed through the heated coke, the ignition point is recorded. Carbon dioxide is then passed through the tube, and further heat applied until carbon-monoxide may be detected in the gases; this point being the reaction temperature. The reactivity is obtained by still further heating the coke to 950° C. in a current of oxygen or carbon monoxide, when the proportion of carbon dioxide to carbon monoxide in the waste gases gives a measure of the reactivity. Valuable information can be obtained by investigations along such lines.

Iron and Steel Corrosion.

Mr. U. R. Evans has made a further contribution to this subject, and in a paper appearing in the Transactions of the Society of Chemical Industry deals especially with water-line corrosion—a matter of particular interest on the gas-works. Details are given of steels submitted to immersion tests in various dilute aqueous solutions; and, though useful information is yielded by such tests, it is pointed out that loss of weight of specimens treated in this way gives no correct indication of the damage done. The reason for this is due to the fact that, though equal amounts of corrosion may have taken place with two samples, in the one case the action may be local, and so result in pitting or even actual perforation, while in the other the damage may be general, and hence of much less significance so far as the life of an article may be concerned. The use of corrosion inhibitors is discussed at length.

Fractionation.

Interesting data regarding the working of fractionating columns having moving parts have been obtained by Messrs. Myers and Jones; and the report of their investigations has appeared in the Journal of the Chemical Society. The efficiency of fractionation, and also of gas washing, is, of course, largely dependant upon thorough contact between the vapours and liquids in the successive sections of the column; and the simplest mechanical aid to this end takes the form of a vertical revolving shaft with suitable plates or discs which serve to scatter the descending liquids as they pass from section to section. In separating the constituents of a mixture of benzene and toluene by fractional distillation, the influence of the speed of rotation of the shaft was very marked; increase of speed resulting in more complete separation. This principle, which has been employed for years in certain types of vertical gas washers and ammonia stills in use in the gas industry, should find practical application on large-scale distillation plants, provided the probably greater initial cost and running expenses (as compared with those of the ordinary bubbling type of column) are compensated by increased efficiencies and throughputs. On such a scale, however, it is likely that some device for separating entrained spray will be found a necessary adjunct; and since the peripheral velocity of the disc is a determining factor, comparatively low speeds of rotation could be employed.

Gas Analysis.

Two new reagents for the absorption of oxygen from mixtures of gases have been put forward. L. F. Fieser advises the use of a mixture of sodium anthraquinone sulphonate and sodium hyposulphite (see Journal of the American Chemical Society), and claims that this reagent works as quickly as the ordinary alkaline pyrogallol solutions in everyday use. Another reagent is due to Hofer and Wartenburg, who give, in "Zeitschrift für Angewandte Chemie," details of a method for determining oxygen. A solution of indigo carmine in sodium hyposulphite is employed, and a change of colour as compared with standards is noted after the passage of a measured flow of gas. Thus the oxygen content is arrived at after suitable corrections have been made.

"Zeitschrift für Physicalische Chemie" gives a method, due to L. Löwenstein, for determining hydrogen and methane. The gas containing these constituents is passed with an excess of oxygen through a combustion chamber, and the water formed (hence the hydrogen equivalent) is indicated by means of a hair hygrometer. Two new types of gas analysis apparatus designed by M. Dirken (Journal of Scientific Instruments) and H. D. Murray (Journal of the Chemical Society) have been noted. The former apparatus possesses a readily detachable absorption vessel in which the sample is shaken; and during this interval further samples may be dealt with in additional absorption vessels. Thus, when a large number of tests are required in a short time, this arrangement is particularly useful. Mr. Murray's apparatus is a portable one; and for this feature particular advantages are claimed. The burette has a three-way tap at the top; one limb leading to the sampling tube and the other to another three-way tap. This latter serves a receiving vessel containing mercury, and a special pipette. The gas sample is drawn into the burette containing water, and then passed through a jet into the absorbing solution in the pipette. Finally it is returned to the burette for re-measuring. Further absorptions are made in the receiving vessel, which may alternatively be used as an explosion vessel for determinations of hydrogen and methane.

Ammonia Estimation.

The determination of ammonia in its salts may be made by adopting the method outlined in "Zeitschrift für Analytische Chemie" by S. Lövgren. According to this method the solution of the salt is titrated with standard caustic soda, and thymol phthalein is used as indicator, giving a blue colour when the equivalent amount of alkali has been added. To obtain correct indication, one of the necessary precautions is that the solution contains at least 50 p.ct of alcohol; but the use of this may be dispensed with by making comparison tests.

Laboratory Apparatus.

"Chemistry and Industry" publishes a description of a laboratory wash-bottle designed by E. A. Roff. This enables a steady jet of liquid to be directed without the need for continuous blowing. In principle it is similar to the familiar type fitted with a bunsen valve on the inlet tube, and having a release tube controlled by the finger. The improvement consists of having a glass valve on the inlet tube, instead of a rubber one, which easily perishes. A further glass valve is fitted at the bottom of the outlet tube; and this serves to keep the jet always full of liquid, so preventing splashing when washing precipitates on filters, &c.

The mention of filters brings to mind the new sintered-glass filters manufactured in Jena and now being marketed in this country. These should rapidly find favour in gas-works laboratory operations. A recent illustrated list issued by Messrs. Baird and Tatlock gives full particulars of the various types of apparatus obtainable fitted with this filtering medium. By their use, ordinary filter-papers may be dispensed with in many quantitative and qualitative tests; some idea of the wide range and nature of their application being given in the descriptive list referred to.

Institute of Cost and Works Accountants.—The fourth annual costing conference will be held at the Hotel Great Central, Marylebone Road, London, N.W., on Friday, May 1.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Discussion on Maintenance.

(*Concluded from p.* 178.)

Mr. H. H. GRACIE (Edinburgh) said it was imperative, if they were to retain the business they already possessed, that some form of free maintenance should be introduced. They were therefore indebted to those pioneers who had taken, and were taking, active steps to promote such an end. Some time ago a proposal originated with the Housing Committee in Edinburgh to the effect that the Gas Department should maintain the installations in good order; even to the extent of supplying mantles for the incandescent burners. The idea was that an extra charge should be made for the gas consumed by way of prepayment meter. The majority of the Gas Committee, however, did not favour the upkeep of mantles, though a suggestion was made to limit the number given free per annum, and it was also arranged to leave a spare mantle free in case of emergency. A modified scheme was prepared, under which four regular visits to each house per annum were to be made, when the various burners and apparatus were to be cleaned, adjusted, and put in full working order. Any other attention required was to be notified by a consumer by postcard or otherwise. Under this scheme, the extra charge for gas was comparatively small; but it did not receive the sanction of the Committee. The good results obtained in other towns might, however, cause his Committee to reconsider their decision on this important question. It seemed to him that attention should be directed to the steps being taken by a strong Committee of the National Gas Council to submit suitable suggestions to the Board of Trade for the examination of all piping, fittings, and appliances on the premises of consumers. The work which was now being carried out in many centres in connection with maintenance schemes was sure to disclose much valuable information. While they had not in Edinburgh a complete door-to-door visitation for the purposes of maintenance, still, they had a very complete system for following up and maintaining cooking, heating, and hot water appliances. One would expect that, with a well-planned scheme of this sort, the condition of the appliances would be so improved that attention would be required only at comparatively long intervals; and as a result, the general run of complaints would be reduced. He would like to ask those who had followed out this practice whether it was their experience that, after an appliance had been thoroughly overhauled and the defects remedied, it could safely be left without further care. The showrooms—or, as they were sometimes wisely called, the demonstration rooms—were now playing an important part in the maintenance campaign, by displaying under the best working conditions only the latest appliances. There was no doubt that they were promoting a good feeling with the plumbing and ironmongery trades; and their ideas of selling the goods to yield them a fair margin of profit was bringing people to the showrooms to make purchases. In this way it seemed to him they were ensuring that only the most reliable, as well as the most efficient, appliances were being fixed in the district. The ideal would be realized if they could get all the tradesmen to come to them for their supplies. If they could not do this, it would be only open to them to purchase and fit appliances which the Gas Department had tested and proved to be thoroughly reliable and economical in every way. The whole gas concern, which, in municipal areas, was the property of the community, would then be carried on in the best interests of the community. They must bring home to the gas consumer the fact that they were his best friends. They must show him that they were out to save him from the ill-suited and ill-designed fittings to be found in almost all districts.

Mr. DAVID VASS (Perth) considered the subject was one they should seriously take to heart. In Perth they had been following somewhat on the lines suggested by Mr. Napier. They had a public showroom, and supplied from there the whole trade of the district. The Gas Department worked very harmoniously with the plumbing trade. Following out, however, the suggestions made by Mr. J. W. M'Lusky in the course of his Presidential Address to the Association last year, the question of maintenance had been tackled in Perth. A proposal was made that mantles should be provided over the whole city for a year at a fixed charge; but that idea did not "catch on," and he began to consider seriously if something on the lines of the Glasgow scheme would not be practicable in Perth. In the old days, they had a system of inspection of fittings; but due to economy, or some idea of that nature, the system of inspection was allowed to lapse. Later he suggested reviving that system of inspection of all appliances; arguing that the Gas Department were losing all over the town to electricity, and that the one way of successfully coping with the opposition was to have two or three fitters specially trained for the work to make a door-to-door canvass of the city. Experience had shown that if people were dissatisfied they were likely to continue dissatisfied so long as no official or fitter from the Gas Department visited them. He enumerated a few instances of pleased consumers, and maintained that these had resulted from the maintenance and inspection scheme which had been adopted in Perth. The scheme had only been in operation since Jan. 1, and so it was probably premature to say much on the question of cost. The expenditure in wages ran to something like one-third of a penny; and so far as he had gone, he was quite confident that the same staff as at present would be able to overtake the whole town and give two visits each year to all the districts. From his own experience, he thought Mr. M'Lusky's figures were quite well founded, and that all undertakings in the country ought to take the forward step of free maintenance. He had omitted to say that in Perth they started away with a scheme of renewing service pipes over the whole town; and this scheme had been in operation now for eighteen months. Originally it was intended to spread the work over five or six years; but they had since decided to concentrate on a complete renewal. The result was that every service in the town would be ample for years to come.

INDUSTRIAL CONSUMERS AND MAINTENANCE.

Dr. E. W. SMITH (London) asked if the maintenance scheme in Glasgow covered industrial gas. If so, what happened if they found that for a particular operation the appliance used was not the right one? He knew it was a difficult point to settle. He came across an instance of this in the printing trade in London. Two years ago, probably about 5 p.ct. were on gas for metal melting; but now the remaining 95 p.ct. had adopted the idea, and were effecting a considerable saving. He supposed that with a proper maintenance system the gas undertaking would satisfy itself that the particular plant which was being used was the proper one to work with.

Mr. S. MILNE (Aberdeen) felt the time was coming when they would have to face this question of free maintenance. In Aberdeen, since they put in gas radiators, they had made a periodical inspection of them; but up to the present they had not gone in for a properly-organized scheme. Mr. Vass had pursued the proper policy in tackling the service pipes. Proprietors of the older properties were slow to move in the matter, especially if it involved expenditure. Obviously the proper thing to do was for the gas industry to do the work itself. He had been struck with the figures given by Mr. M'Lusky. Certain inquiries that he (Mr. Milne) had made into this question of free maintenance had caused him to reckon that it would take about 2d. per 1000 c.ft. of gas used for domestic purposes only. Mr. Napier had rather suggested that the industrial consumers would have nothing to say, because they already had a special rate. This might be true; but he thought they should not stop at the domestic consumer. In Aberdeen they had lately introduced the practice of going over hotels, restaurants, and such places; and he was bound to admit that these quarterly inspections had been greatly appreciated. They charged a small fee, which was not grudged. He would like to ask Mr. M'Lusky how often particular premises would be visited in the course of a year; and he would also be glad to have an outline of the work done by the inspectors in Glasgow. Was each inspector confined to a particular district, and had he allocated to him a certain number of houses? Further, did the Glasgow Corporation supply gas brackets and pendants, and what was the position if, for instance, chandeliers were condemned? He noticed Mr. Napier advocated a service pipe laid at the expense of the gas supplier right up to the meter. Had Mr. Napier adopted this scheme in his own case?

Mr. J. J. SCOTT (Cowdenbeath) said in his district they had all along supplied a free service right to the meter. Not only so, but supplied free cookers. Indeed, they went even further than this, and actually provided internal fittings. During the past four years or so, they had added something like 1300 new consumers in whose houses they had supplied internal pipes, brackets, and fittings. Such a scheme as this appealed most strongly to him in that it made every householder a consumer. They charged a small additional sum per 1000 c.ft. to cover the cost of the internal piping system. They had trained their consumers to report all complaints in any shape or form. Indeed, they had educated them up to the practice of applying for information, assistance, and advice at the district gas office or showroom. Cowdenbeath was a mining locality, and not unnaturally they had experienced a good deal of trouble because of underground workings. The cost of the free maintenance scheme in Cowdenbeath did not exceed ¾d. per 1000 c.ft. He had been much impressed by the data given by Mr. M'Lusky, and would carefully examine the possibilities of changing-over to a definite periodical visitation scheme.

Mr. R. STURROCK (Ardrossan) explained that in his district they introduced a maintenance scheme eighteen months ago, and the cost worked out at 0·52d. per 1000 c.ft. Complaints had been considerably reduced.

Mr. A. DOW (Galashiels) could not give any figures relative to his maintenance scheme, because it was in its infancy. Inspectors had been instructed to make periodical visits, and the expectation was that each house would be visited at least once every three months. They did not propose to stop at supplying domestic fittings. In fact, in a preliminary sort of way, they had been giving attention to gas engines and industrial consumption generally. They had on the staff an engineer trained in gas engine work, and his services were always available to consumers. A record was kept of the consumption of gas among the power users; and if in any particular factory or workshop it appeared to be abnormal, an immediate visit was paid to the place, and inquiry made as to the reason. Should the gas engine require attention, a report was made as to the overhaul necessary; and if the manufacturer gave his sanction, the Gas Department were prepared to undertake the work. By this plan of campaign they had retained a good deal of valuable engine consumption in the district. Free maintenance ought not to stop at the domestic consumer. It could be adopted with success in industrial centres.

PIPING SCHEDULES.

Mr. JOHN WILSON (Motherwell and Wishaw) said it had been stated that one of the first things in maintenance was the service pipes. He would include in maintenance, not only the service pipes, but the pipes in the houses themselves. What was the use of providing a proper service pipe, if the pipes in the houses were not in proper order? Had not the time come when the National Gas Council or some such body—the Scottish Section of the Council could do it—should schedule the sizes of service pipes for various houses and conditions? At the same time, a schedule could be drawn-up of the sizes of pipes for carcassing houses. The time had come when these things should be put down in black and white by a responsible body. This had been done already under the Gas Regulation Act with regard to the quality and pressure at which gas was supplied. It was only reasonable that house proprietors should be compelled to put in such pipes as were required by the schedule. Gas departments should have the same rights as water departments—to insist upon defects being put right. Mr. M'Lusky's figures, he believed, would prove effective in convincing gas companies and corporations that free maintenance paid its way. Perhaps Mr. M'Lusky would enlighten the meeting as to the type of individuals he employed as maintenance men. While speaking of reform, it might now be made clear that the town or burgh chamberlain's duty, in a municipal sense, should stop at the collection of the cash. The gas department

should control their own work right to the consumers, and be responsible for the reading of meters and the preparation of accounts.

Mr. David Fulton (Helensburgh) said they must first of all be satisfied that in the works they were producing absolutely pure gas. Then he was quite sure that the cost of maintenance would be negligible.

Replies by the Authors.

Mr. M'Lusky, replying to some of the points raised, remarked that Dr. Smith seemed to be concerned about industrial plant. In Glasgow there were a number of industrial plants; and it was the duty of the maintenance men to see that the regulation was right. If any point of difficulty arose, the maintenance staff could report to others who had charge of bigger industrial plants. The ordinary maintenance men were not expected to tackle a heavy industrial undertaking, except to make small adjustments and give advice. When they came to the end of May, he would have completed four financial years of the service pipe campaign, and in that time would have laid down a total of 30,000 pipes. From his own experience, he would say that, if they could guarantee to visit houses twice a year, it would make a great improvement. Eventually the maintenance might be extended to three times a year, but he would not go the length of saying that there should be four visits annually. As a matter of fact, twice a year to begin with would probably give satisfaction. In Glasgow they had sectional depôts and centres; and the system on which they operated was that one inspector had charge of 10,000 consumers. The ultimate scheme was to be ten inspectors, with forty men each. At the moment they were now running with 215 men—consisting of 184 actual house-to-house maintenance men, 9 staff repairers, 11 inspectors, 2 storekeepers in the depôts, 8 clerks on the general clerical work, and 1 controlling superintendent. The meter inspectors in Glasgow were clerks. Their duty was to read the meter and book the record. On the other hand, the maintenance staff was drawn from plumbers and gasfitters—men who had gone through a special test and training for work of this kind. In the selection of these men, regard must be had to their appearance and general demeanour. Men of the type required were not very plentiful. There were plumbers and gasfitters who would be useless for maintenance work. In regard to the apportionment of the cost of the Glasgow maintenance scheme, the principle followed was to calculate the charges on the total consumption of the city. The viewpoint they adopted was that everybody in Glasgow must pay for the maintenance scheme. He did not see how the allocation could be made in any other way. His costs had come down automatically, because they had done the worst parts, and were now passing into better property. The cost would remain, he should say, at ½d. He did not think it would be possible to bring it below this.

Mr. Napier said it appeared to him that the gas undertaking in the future must include, not only the manufacturing works and the distribution system, but all appliances used by consumers. Town councils, in the matter of laying-out new roadways and pavements, called upon the proprietor to meet the first cost. Afterwards the local authority took over these roadways and pavements and maintained them. This was done in the interests of the community. Gas supply also was a communal necessity, and he saw no objection to the local authority obtaining powers for the gasfitting of houses to be carried out to their approved specification. The initial expenses would be met by the proprietor, and afterwards by the gas department. This would strengthen very much the efficiency of gas supply. He put forward the suggestion as a practical one for the future. He looked upon it as a method of making certain that the gas industry would be put on a standard basis. As to Mr. Milne's question relative to service pipes, he felt that the proprietor should pay for that portion of piping laid on private ground. As indicated in the paper, he advocated that the work of maintenance should be subsequently carried on by the gas department. So far as Alloa was concerned, they had not carried out any such scheme in a wholehearted manner; but he had ventured to put the proposition forward as one worthy of consideration and acceptance by the officials of gas undertakings. Personally he hoped that the early future would see such a change in the affairs of gas supply as he had endeavoured to outline in his paper.

"B.C.G.A." North Wales and Cheshire District Conference.—Under the Presidency of Sir John M. Frost (Chairman of the Chester United Gas Company), a British Commercial Gas Association District Conference is to take place next Wednesday (April 29), in the Assembly Rooms, Newgate Street, Chester. The Mayor (Alderman David Lythall Hewitt, J.P.) will welcome the delegates; and there will be luncheon at the Grosvenor Hotel, and a visit after tea to a local gas exhibition. For the business sessions there will be an address by Mr. W. M. Mason, and papers by Mr. Owen Evans (Engineer and Manager to the Wrexham Gas Company), Mr. D. Rennet, M.B.E., M.D., D.P.H. (Medical Officer of Health to the City and County Borough of Chester), and Mr. Harold Hartley, D.Sc.

Tar Plants.—A "T.I.C." (lead) tar dehydrating plant supplied by the Woodall-Duckham Vertical Retort and Oven Construction Company, Ltd., has just been put into operation at the works of the March Gas Company, and is, we understand, working very satisfactorily. Orders have also been received by the Woodall-Duckham Company for bitumen and tar mixing plants from the City and Royal Borough of Dunfermline Gas Department, the Gas Department of the Alloa Town Council, and the Dundee Corporation Gas Department. The production of Road Board tar and bitumen tar mixtures by the gas undertakings of Scotland is being taken up with a considerable amount of enthusiasm, as the profits to be gained in the production of such materials by the gas undertakings themselves are considerably greater than those obtainable from the sale of crude tar.

GASHOLDERS: THE USELESS TOP LIFTS.

By Norton H. Humphrys.

The subject of storage capacity as compared with the output of gas, though prominent in the early days of our industry, is now rarely heard of. The output of gas has tended to spread evenly over 18 hours out of the 24, thus diminishing the degree of variation in the gasholder contents. The difference between maxima and minima, once over 50 p.ct. of the daily output, is now a mere trifle, perhaps not exceeding 10 p.ct.

Night work tends to increase, even in small towns; and frequently the consumption keeps step closely with the make, with the exception of a slight gain between midnight and 6 a.m. Accumulated experience is such that a temporary stoppage of the make, due to obstruction or other trouble at some point between the retorts and the gasholders, is practically unknown to the younger generation of gas engineers. Modern manufacturing plant is more extensive in variety, more reliable, and more elastic as regards rate of production of gas, than the 9 ft. horizontal retort which at one time was exclusively used. The continuous vertical retort and the cupola type generator enable the production to be kept nearer in line with the output. This state of things is a great advance on the time when the bulk of the consumption came between dusk and 11 p.m., and troubles due to pitch, naphthalene, and frost were part of the regular winter experiences—to say nothing of fog and November afternoons. From motives of economy in first cost, the manufacturing and purifying plant at the smaller class of works then consisted to a large extent of cast-off plant from the larger—often antiquated and inefficient in pattern, or as much a misfit as "father's old clothes."

Hence the remarkable fact that the obsolescence of about half the storage capacity, due to its not being equal to the pressure demands at the governor outlet, has been accepted with indifference. In order to comply with the pressure clauses included in the Gas Regulation Act, 1920, not less than 40-10ths is needed; but the usual top or single lift pressure is in the neighbourhood of 30-10ths. Sometimes boosters are put down with the view of meeting this defect; but the majority have not experienced any inconvenience, and have scarcely noticed the difference. The established rule of storage capacity—*i.e.*, total holder delivery content equal to 24 hours' maximum output of gas—was perfectly sound when applied to the conditions under which it originated, but is quite out of tune with modern requirements. Many gas-works have 100 p.ct. total holder content in accordance with this rule, but only 50 p.ct. of available storage capacity that can be distributed under at least 40-10ths pressure.

A fair representation of the average state of affairs at a gas-works supplying 100 to 125 million c.ft. of gas per annum is three holders, respective capacities 100,000, 200,000, and 400,000 c.ft.—a total of 700,000 c.ft. of gas—approximating to the above rule. These were in every respect efficient up to within the last twenty years or so. As late as 1895, in the course of a paper read before the Incorporated Gas Institute, entitled "Unaccounted-for Gas," Mr. D. Irving accurately voiced the current opinions among gas engineers by the statement that, if the district requirements could not be met with 18-10ths pressure at the governor outlet, enlargements of some of the mains should be considered. At that date, single-lift holders were more in evidence, and took a large share in the work of distribution; but to-day we shall not be far wrong in stating that the bulk of the work falls on multiple-lift holders. All subsequent enlargements or additions have been supplied with not less than two lifts; but in the above example only 300,000 out of 700,000 c.ft. of gas is available at full pressure.

At first sight one might conclude that top or single lifts can be used for 8 or 10 hours out of the 24. Stated in terms of hours, this is 33 to 40 p.ct. of the whole; but measured by the proper standard—thousands of cubic feet of gas—the proportion is nearer 4 p.ct. A more important difficulty is that the top lift takes precedence of the lower ones. They cannot be brought into active service unless the top lift is full. If the lower lifts could be worked independently, the position would be different. Unless the make does, or can be made to, outstrip the output, which is very improbable, the effect of starting (say) at 6 a.m. with the top lift half-empty will be a deficient supply until the top lift is again clear above water, which may not be possible until after the following midnight. Consequently many multiple-lift holders in use to-day have not had the first cup under water for months, and perhaps years. Yet no deviation is noticeable from the beaten track, and holders are being designed and erected on the old lines of a pressure of about 30-10ths off the first, and an additional 20-10ths as each succeeding lift cups. So far from a reduction towards the 1895 18-10ths, distribution pressures are being increased to such an extent that before long the second lift may be as inefficient as the first is at present. It is difficult to see where the engineer would be prejudiced, if his 700,000 c.ft. storage were replaced by 300,000 c.ft. under not less than 50-10ths pressure.

An example of the possibility of working efficiently with a small storage factor is furnished by an 80 million c.ft. gas-

works. The holder capacity (total) was ample, but chiefly concentrated in one 90 ft. double lift; the only addition being a 40 ft. double lift, the lower half of which represented less than 10 p.ct. of the 24-hour output. The tank of the large holder leaked badly, and during twenty years the amount expended on pumping approached the original cost of the holder. Two successive managers held that the loss was unavoidable, as the holder could not be put out of action for a time sufficient to repair the tank without practically shutting-down the works. A third manager thought he could tackle the problem, although he had only old pattern 9-ft. ⌂ section retorts in the retort house; and he succeeded in maintaining an efficient service for six weeks with the large holder out of action. No specific complaint was received at the rental office, and outside the works there was no knowledge of any special matter in progress. The carbonizing account for the year showed no extraordinary increase.

There is no reason to suppose that this experience is unique; and doubtless similar examples might be quoted in proof of the fact that an efficient supply can be maintained on a storage capacity much less than 50 p.ct. of the 24-hour output. This means that the cost of gasholders, the effect of which on the selling price of gas has been a matter of frequent comment, can be substantially reduced, not in the same proportion per 1000 c.ft. capacity, but to a degree sufficient to exercise important effects on the selling price of gas by reducing the capital outlay per million c.ft. of gas made per annum. Smaller holders mean not only lower first cost, but reduced annual expenditure for maintenance and upkeep.

That useless top lift should therefore be abolished, if it cannot be brought into useful service, by some system of loading. If of no use, it certainly is no ornament, and sometimes an objection to neighbouring residents. A time has arrived when the whole question of storage, the safe or necessary working margin, and methods of construction, especially in reference to pressure capabilities, might be fully examined. Some years ago it was the custom to enlarge on the advantages of a 24-hour storage; but with the levelling-down of the demand towards one even hourly rate on the one hand and increased elasticity of manufacturing plant on the other, the need for such provision is steadily disappearing. The suggestion that high-pressure reservoirs might efficiently replace the bulky and costly gasholder is not so absurd as it seems at first sight. Perhaps some daring engineer will bring out a scheme for dispensing with storage by methods of adjusting the make to fit the demand.

REGENERATION OF COMBUSTION GASES.

[A Communication from the Karlsruhe Gas Institute, "Das Gas- und Wasserfach," Feb. 7, 1925.]

The proposal has recently recurred that a proportion of the combustion gases in producer practice might be withdrawn as they enter the recuperator, and that, instead of steam, gases containing carbon dioxide should be introduced with the combustion air under the producer grate. It is suggested that a considerable economy in fuel can be effected in this way. As this proposal is continually coming up from one quarter or another, the Gas Institute decided to probe it thoroughly once and for all, and to clear up the facts.

Let it be assumed first that half of the combustion gases are withdrawn, that is, 1 cub.m. out of 2 cub.m. of waste gases, and that this is returned under the grate together with 1 cub.m. of air; then the process is as follows:

In the combustion gas there are about 4 cub.m. N_2 to 1 cub.m. CO_2. If this CO_2 is used to take up carbon from the solid fuel, then 0·536 kg. of carbon can be gasified per cub.m. CO_2, and 2 cub.m. CO formed.

$$C + CO_2 + 4\,N_2 = 2\,CO + 4\,N_2 - 1731 \text{ calories.}$$

There are, therefore,

Taken from the producer	− 1731 calories
Developed in the settings	+ 6068 ,,
	4337 calories

The heat developed in 1 cub.m. CO_2 is thus passed from the producer to the settings, with the formation of 10 cub.m. of waste gas (2 cub.m. CO_2 + 8 cub.m. N_2). If, instead, the producer temperature is lowered in the usual way by the introduction of steam, the reaction, again theoretically, is

$$C + H_2O = CO + H_2 - 1267 \text{ calories.}$$

To produce the same cooling effect in the producer, however, the decomposition of $\frac{1731}{1267} = 1{\cdot}37$ cub.m. of steam can be assumed.

$$1{\cdot}37 \times [(CO + H_2) + O_2 + 4\,N_2] = 1{\cdot}37 \times [CO_2 + H_2O + 4\,N_2 + 3034 \text{ cal.} + 2570 \text{ cal.}]$$

Therefore there are developed in the settings

$$1{\cdot}37 \times (3034 + 2570) \text{ cal.} = 7677 \text{ cal.}$$

with the formation of combustion gas

$$1{\cdot}37\,CO_2 + 1{\cdot}37\,H_2O + 4 \times 1{\cdot}37\,N_2,$$

or a total of 8·22 cub.m. waste gas. For 1000 cal., therefore, which are withdrawn from the producer, there are developed in the oven

By waste-gas regeneration, 3500 cal. with 10 cub.m. combustion products.
By steam decomposition, 4430 cal. with 8·22 cub.m. combustion products.

From which it appears there is no advantage in the regeneration process, but rather the contrary.

It is, however, claimed that the method effects a saving of 10 to 15 p.ct. of fuel in the grate, corresponding to the heat which is brought back under the producer in the waste gas—and this without any change in the final quantity of waste gas and its heat content. The whole cycle may, therefore, be followed out mathematically.

Of 2 cub.m. of waste gas, assume that one-third is withdrawn and returned to the producer together with 1 cub.m. of air.

1 cub.m. air + 0·66 cub.m. waste gas	
0·2 × 0·66 CO_2	= 0·132 CO_2
0·8 × 0·66 N_2	= 0·528 N_2
0·8 × 1 N_2	= 0·800 N_2
0·2 × 1 O_2	= 0·200 O_2
1·660 producer air.	

Heat contents of producer air (waste gas at 1000° C.)

0·132 × 1000 × 0·511	= 67·5
0·528 × 1000 × 0·331	= 175·3
1000 × 20 × 0·312	= 6·2
	249·0 cal.

Heat changes in producer

0·132 (CO_2 + C = 2 CO) × (− 1731)	= − 228 cal.
0·1 (2 C + O_2 = 2 CO) × (+ 1303)	= + 260 ,,
0·1 (O_2 + C = CO_2) × (+ 4337)	= + 434 ,,
	466 cal.

At the outlet of the producer there are therefore available

249 + 466 cal. = 715 cal.

Composition of the producer gas

0·264	cub.m.	CO	24·5 p.ct.	CO
0·2	,,	CO		
0·1	,,	CO_2	5·3 ,,	CO_2
1·328	,,	N_2	70·2 ,,	N_2
1·892			100·0	

Theoretical temperature of the producer gas

$$\frac{715}{0{\cdot}1 \times 0{\cdot}514 + 1{\cdot}792 \times 0{\cdot}333} = 1100° \text{ C.}$$

Combustion of the Producer Gas

Producer Gas.	Air Required.		Combustion Products.	
	O_2	N_2	CO_2	N_2
0·1 CO_2	..	..	0·1	..
0·464 CO	0·232	0·928	0·464	0·928
1·328 N_2	..	..	..	1·328
1·892	..	..	0·564	2·256
	1·160 air.		2·820 waste gas.	

The result, therefore, is 2·82 cub.m. of waste gas instead of 2·0 cub.m. Of this, 0·66 cub.m. would be introduced under the producer, and the remainder, 2·14 cub.m., will be required to preheat 1·16 cub.m. of air.

There is available for the oven

1. The heat of the producer gas	715 cal.
2. The combustion heat 0·464 × 3034	= 1410 ,,
3. The heat of the combustion air (900° C.)	
1·16 × 900 × 0·33	= 345 ,,
	2470 cal.

Extreme temperature of the combustion

$$\frac{2470}{0{\cdot}564 \times 0{\cdot}562 + 2{\cdot}256 \times 0{\cdot}358} = 2200° \text{ C.}$$

Heat content of waste gases at 1000° C.

0·564 × 0·511 × 1000	= 288 cal.
2·256 × 0·332 × 1000	= 726 ,,
	1014 cal.

The heat available for the settings is, therefore,

2470 − 1014 = 1456 cal.

With this regeneration of one-third of the waste gases, the expenditure of carbon for the heat production may be calculated as follows. In the producer gas there are 0·564 cub.m. of gases containing carbon. The quantity of waste gas used introduces 0·132 cub.m., so that there are produced 0·432 cub.m., and 0·432 × 0·535 = 0·232 kg. of carbon, which is, therefore, the quantity required for 1456 cal. in the combustion chamber. This, with a calorific value for the carbon of 8100 cal., represents 0·232 × 8100 = 1880 cal.

For 1000 cal. in the combustion chamber, therefore, 1290 cal. in the coke are consumed.

With this must now be compared the conditions when the

lowering of the producer temperature is effected by decomposition of steam instead of waste gas.

PRODUCER GAS WITH STEAM DECOMPOSITION.

An equal total calorific value of the producer gas must be assumed. In the previous example, 1·892 cub.m. contained 0·464 cub.m. of CO, or, with the regeneration of the waste gases, 1410 cal. Taking a water gas of the following composition

CO_2,	5 p.ct.		
CO,	28 ,,	. . . . . 0·28 × 3034 =	850 cal.
H_2,	10 ,,	. . . . . 0·10 × 2570 =	257 ,,
N_2	57 ,,		

the calorific value is 1107 cal. per cub.m.

The composition of the assumed producer gas is correct, since for 57 volumes of N_2 there are 14 volumes of O_2. Of these, 5 volumes are used to form CO_2, leaving 9 which may form 18 CO. There remain 10 CO, which, together with 10 H_2, have been produced by the reaction

$$C + H_2O = CO + H_2.$$

In order that the same calorific value as before may be available with this producer gas of 1107 cal. per cub.m.—*i.e.*, 1400 cal.—1·28 cub.m. of semi water gas must be produced, thus

0·064	cub.m.	CO_2
0·358	,,	CO
0·128	,,	H_2
0·730	,,	N_2
1·280	cub.m.	

the formation of which produces

0·064 (C + O_2 = CO_2 + 4337 cal.)	= + 278 cal.
0·128 (C + H_2O = CO + H_2 − 1267 cal.)	= − 162 ,,
0·230 (C + ½ O_2 = CO + 1303 cal.)	= + 300 ,,
	+ 416 cal.

Heat contents of the steam (assuming 50 p.ct. excess)

$$\frac{0\cdot192}{0\cdot8} \times 639\cdot7 = 153\cdot5 \text{ cal.},$$

or preheating the primary air to 400° C.

$$\frac{0\cdot73 \times 100}{80} \times 0\cdot320 \times 400 = (117 \text{ cal.})$$

So that at the outlet of the producer there are available

I. 416 + 153 = 569 cal. without preheating of air.
II. 416 + 153 + 117 = 686 cal. with preheating.

From which the temperature of the gas may be found as

$$\text{I.} \quad \frac{569}{0\cdot064 \times 0\cdot524 + 0\cdot128 \times 0\cdot335 + 1\cdot088 \times 0\cdot338 + 0\cdot064 \times 0\cdot410} = 1230^\circ \text{ C.}$$

$$\text{II.} \quad \frac{686}{0\cdot064 \times 0\cdot530 + 0\cdot128 \times 0\cdot338 + 1\cdot088 \times 0\cdot341 + 0\cdot064 \times 0\cdot419} = 1420^\circ \text{ C.}$$

Air and Combustion Products.

Producer Gas.	Air Required.		Combustion Products.		
	O_2.	N_2.	CO_2.	H_2O.	N_2.
CO_2 0·064 . . .	..	..	0·064	..	..
CO 0·358 . . .	0·179	..	0·358	..	..
H_2 0·128 . . .	0·064	..	..	0·128	0·730
N_2 0·730 . . .	..	0·972	..	0·064	0·972
	0·243	0·972	0·422	0·192	1·702
	1·215 cub.m. air		Waste gas, 2·316		

Heat contents of the combustion air at 900° C.

$$1\cdot215 \times 0\cdot329 \times 900 = 360 \text{ cal.}$$

Available for the oven

Heat of the producer gas	569 cal.
Combustion heat of the producer gas	1410 ,,
Heat of the combustion air	360 ,,
	2339 cal.

Extreme temperature without preheating the air

$$\frac{2339}{0\cdot422 \times 0\cdot568 + 0\cdot192 \times 0\cdot506 + 1\cdot702 \times 0\cdot362} = 2425^\circ \text{ C.}$$

Extreme temperature with preheating of the air

$$\frac{2456}{0\cdot422 \times 0\cdot570 + 0\cdot192 \times 0\cdot517 + 1\cdot702 \times 0\cdot364} = 2530^\circ \text{ C.}$$

Heat contents of the combustion products at 1000° C.

0·422 × 0·511 × 1000 =	216 cal.
0·192 × 0·398 × 1000 =	76 ,,
1·702 × 0·332 × 1000 =	565 ,,
	857 cal.

Therefore there are available for the settings

2339 − 857 = 1482 cal. in case I.
2339 + 117 − 857 = 1599 cal. in case II.

The consumption of carbon is

$$0\cdot422 \times 0\cdot536 = 0\cdot226 \text{ kg.}$$

Taking the calorific value at 8100 cal. per kg., this makes 1830 cal.

For 1000 cal. in the combustion chamber, therefore, there are required in case

I. 1230 cal. from the coke.
II. 1145 ,, ,, ,, ,,

Finally, the heat available in the waste gases must be estimated, as being employable up to 300° C. for steam raising. In all, taking the regeneration process first, there are 2·820 cub.m. of waste gas, of which 0·66 cub.m. is returned to the producer for regeneration. This leaves

2·160 cub.m.—0·432 cub.m. CO_2 and 1·730 cub.m. N_2.

Heat contents of this at 1000° C.

0·432 × 0·511 × 1000 =	221 cal.
1·730 × 0·332 × 1000 =	575 ,,
	796 cal.

At 300° C.

0·432 × 0·442 × 300 =	57 cal.
1·730 × 0·318 × 300 =	165 ,,
	222 cal.

Difference 796 − 222 = 574 cal.
For preheating air to 900° C. are required

$$900 \times 0\cdot33 \times 1\cdot16 = 314 \text{ cal.}$$

Leaving for steam raising 230 cal.

In the steaming process, the waste gases at 1000° C. contain

0·422 × 0·511 × 1000 =	216 cal.
0·192 × 0·398 × 1000 =	76 ,,
1·702 × 0·332 × 1000 =	565 ,,
	857 cal.

And at 300° C.

0·422 × 0·442 × 300 =	56 cal.
0·192 × 0·376 × 300 =	22 ,,
1·702 × 0·318 × 300 =	162 ,,
	240 cal.

Difference 857 − 240 = 617 cal.
For preheating air to 900° C. are required

$$1\cdot215 \times 0\cdot33 \times 900 = 360 \text{ cal.}$$

Total available for steam raising	257 cal.
Required for producer steam	153 ,,
Remaining for other steam raising	104 cal.

Summary.

	Heat Charges in the Producer.	Temp. of Gas Produced.	Available for Oven when Waste Gas at 1000° C.	Extreme Temperature of Combustion.	Calorie Consumption of Coke per 1000 Cal. in Oven.	Free Available Waste Heat.
With waste-gas regeneration . .	+ 466	1100° C.	1456 cal.	2200°	1290	230
With ordinary steaming	+ 416	1230° C.	1482 ,,	2425°	1230	104
Do. with air preheating to 400° C. . .	..	1420° C.	1599 ,,	2530°	1145	..

Hence a detailed calculation of the heat processes involved in the regeneration of waste gases from a producer, as compared with ordinary steam injection, shows that no actual advantage is gained by the former method.

Preventing Corrosion.

The belief is expressed by Mr. R. B. Williams, writing in the "Gas Age-Record," that a remedy for wasteful and costly rust will be discovered, now that the problem is being attacked vigorously, and from many angles. He points out the economic importance of the problem to the gas industry, whose tremendous advancement will call into use a vastly increased amount of metallic surface. Even now, he says, metallurgists are learning to incorporate with iron a proportion of chromium; and when this proportion amounts to from 12 to 18 p.ct., a rustless iron results which is capable of taking a high polish, and is absolutely impregnable, not only to ordinary atmospheric influences, but even to such powerful corrosive elements as boiling sulphuric acid. Unfortunately, while chromium is not a rare element, it is sufficiently uncommon to make the cost of high-chromium steel prohibitive for ordinary usage. It has been found also that the incorporation of 0·5 p.ct. copper into iron will materially increase the resistance of the resultant metal to corrosive agents. Investigators are collecting more and more information on the causes of corrosion, and more and more material for the development of protective coatings or paints. One railroad, as an instance, has recently found that, by applying a certain protective covering, a marked decrease in corrosive tendency on rails results. Prof. Baker, of the University of Michigan, has discovered a method whereby steel can be electro-plated to a thickness of 0·001 in., instead of the usual 0·0001 in., at very little additional expense. This extra thickness of the nickel-plating affords a protective covering to the base metal that capably resists the test of the United States Bureau of Standards.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Annual General Meeting.

The Annual Meeting of the Association was held on Saturday, April 11, in Edinburgh—Mr. R. L. LAING (Brechin), President, in the chair.

The HON. SECRETARY AND TREASURER (Mr. E. L. Farquhar, Lower Largo) read the annual report of the Council for the 21st session, which stated that eight members had been added to the roll during the session; the total membership now being 117 ordinary members and 16 honorary members. The financial statement submitted showed that at the end of the year there was a credit balance of £50 4s. 11d.

On the motion of Mr. LAING, seconded by Mr. GAVIN (Galashiels), it was unanimously decided to devote a sum of money not exceeding £20 for the purpose of bringing the Association library up to date.

Mr. FARQUHAR intimated that he had decided not to stand for re-election, as he felt that his duties at Largo did not afford him sufficient leisure to devote to Association affairs.

The PRESIDENT remarked on the smoothness with which the business had been carried out during the two years Mr. Farquhar had been in office. The membership had been increased by 25, and the credit balance from £16 to £50.

The following office bearers were thereafter elected for the ensuing session:

President.—Mr. Alan Clark, Perth.
Vice-President.—Mr. H. A. Yuill, Dundee.
Hon. Secretary and Treasurer.—Mr. J. Scobie, Dunfermline.
Council.—Messrs. Carrie, Duffy, and Gavin.
Auditors.—Messrs. J. R. Moyes and J. M'Donald.

With a view to bringing the matter before members, a letter was read from the Institution of Gas Engineers intimating that a register was being prepared for the assistance of those members of the Institution out of employment.

Mr. LAING then delivered his

PRESIDENTIAL ADDRESS.

I have to thank you for the honour conferred upon me by electing me your President—an honour which I feel is considerably enhanced by the fact that during the current session our Association has attained its majority.

EDUCATION.

At present we are very much concerned with education; and I assume that we are agreed that this question in its broadest sense must be kept strictly in the foreground. The Institution of Gas Engineers have laid down a thorough and complete programme which coming gas engineers must follow. The question, however, which is really concerning many of us is how we are to study to the best advantage the subjects prescribed. I am in hearty agreement with the whole scheme, but am convinced that the lack of technical centres of education in the country generally and in this district in particular makes the further education of the gas engineer a problem rather difficult of solution. The average continuation classes in small burghs cannot reasonably be expected to provide facilities for such specialized instruction, where the enrolment must of necessity be small. Reliable guidance to the student with regard to the choice of subjects is a feature which is calculated to make for success. It may be argued that to men of our nationality the problem should present no insuperable difficulty; but until some scheme of suitable curriculum in our technical schools and classes is evolved, and a Director of Gas Education is appointed, there must be a considerable waste of time and energy on the part of the student. The greatest good for the greatest number cannot be obtained by prescribing a highly specialized scheme, and at the same time offering no suggestion as to the best means of carrying the scheme to a successful issue. I am glad to learn that an Advisory Committee for Scotland have been appointed; and I am sure they will do much to advance our claims for recognition in this direction, and put us on a better footing than originally arranged for. We could derive more benefit from an educative point of view from this Association if we maintained a more vigorous campaign of papers and discussions.

CARBONIZING PLANT AT BRECHIN.

The installation is of the Woodall-Duckham type, and consists of two parallel benches of three retorts, regenerators, &c. The retorts are 25 ft. long, tapering from 3 ft. 4 in. by 8 in. to 4 ft. 4 in. by 20 in. at the bottom. The whole plant is capable of carbonizing 21 tons of coal a day—in six retorts of 3½ tons. This throughput can be altered, and it is possible to vary the make per mouthpiece considerably as occasion may demand. At present we have an average output of 62,000 c.ft. per retort per day. The average amount of coke produced is 13 cwt. per ton of coal carbonized; and of this amount, 30 p.ct. is generally required for the producer. This percentage varies according to the numbers of retorts working. On the average, the actual amount of coke for sale is just over 9 cwt., which, with the deduction of breeze, is reduced to nearly 8 cwt. Our net saleable coke figure is 5·9 cwt. This is coke actually leaving the works; the balance being used for steam raising. All coke is sieved through a 1-in. mesh before going to the producer, and is handled by the stokers themselves.

The coal is brought into the coal store by carts, is filled into hutches of 10 cwt. capacity, and elevated to the storage hoppers by a steam-driven lift. The hoppers are so arranged that they hold a three-day supply; and by keeping all the hoppers full, we are assured of a six-day supply. The stokers handle no coal. Two yardmen are engaged from 1½ to 2 hours every morning to fill the storage hoppers; and the lift is used afterwards for elevating coke.

WORKING RESULTS.

Some figures regarding the work done by the plant may prove interesting. The retorts were put to work in July, 1920; and since then our annual make has risen from 41 to 47 millions. The cost of repairs and renewals to date has been £19, which figure includes the conversion of hydraulic to dry seals at the top of the retorts. The remainder is all for bottom ironwork, side bottom plates, and curved door plates which were eaten through by the action of the water and coke. This ironwork was renewed last summer. The brickwork of the retorts, beyond showing a slight picking of the joints round the bottom, is in excellent condition. The materials used were Glenboig. No bulging appears at any part. So far, three retorts only have been in action; and the following figures represent four years' working. The total amount of coal carbonized has been 107,400 tons—an average of 3571 tons per retort. For the same period, the gas (460 B.Th.U.) per ton of coal has been 16,405 c.ft., sulphate of ammonia 26·79 lbs., tar 18·86 gallons, and coke (net for sale) 5·5 cwt. We steam at 15 lbs. pressure; and the original steaming arrangement was altered to one of our own design. With the present system there is no trouble in disconnecting the superheater, and no danger in burning-out during scurfing operations. The present tubes have been doing duty for 2½ years, with no repairs. The retorts are run for twelve weeks without scurfing; and we are in favour of periods not exceeding this. Clean retorts promote steady working, regular coal feed, and consequently a straight line on the calorimeter record.

Indicators are fitted to each auxiliary coal hopper, which can be read at floor-level. There is then no excuse for short or extra coal feed. The attendant is able to watch the working of the retorts without having to climb to the top of the bench. I would certainly recommend this indicator system for small installations. It is not an expensive item, and certainly repays itself in better results and saving of labour. The producer has given us little trouble except with the accumulation of dust and very small breeze at the back wall. If this layer is not attended to, it becomes black and dead, and reduces the area of the producer to a considerable extent. This trouble has been largely overcome by introducing an additional firebar about 18 in. deep, two steps up, which enables the stoker to get right through to the back of the grate, and keep the whole fire always on the move. The producer is pricked-up every four hours, and clinkering is only done at long intervals, much depending on the class of coke in use. In working vertical retorts of the type and size with which I am acquainted, I would summarize the main features of good practice as follows:

(1) Scurf at regular intervals.
(2) Steady make per retort.
(3) Periodical attention to flues, regenerator, and producer.
(4) Ample chimney pull.
(5) Strict attention to exhauster vacuum and retort-house governor.
(6) Interest in the workmen directly connected with the retort house.

A comparison between the first and fourth year's working is interesting:

—	1920.	1924.
Gas manufactured	41,129,600 c.ft.	46,408,000 c.ft.
Coal carbonized	2,787 tons	2,665 tons
Gas made per ton of coal	14,757 c.ft.	17,413 c.ft.
Price of coal per 1000 c.ft. made	1s. 9·9d.	11·59d.
Labour " " " "	10·66d.	8·01d. (includes distribution, sulphate of ammonia, &c.)
Carbonizing costs only " "	5·01d.	3·24d.
Residuals realized " "	1s. 5·90d.	1s. 0·63d.
Coal per ton in works	46s. 9·6d.	31s. 11·1d.
Calorific value of gas	475 to 460	430 to 440
Price per 1000 c.ft.	6s. 8d.	4s. 7d.
Cost of repairs (per 1000 c.ft.)	..	·03d.

As will be observed, our present calorific value is given as 430 B.Th.U.; but in the absence of a total heat calorimeter, and running constantly with the Beasley recorder, I am not claiming this figure with absolute certainty. Two jet photometers are installed in the retort house—one in direct connection with the purifier outlet and placed in a convenient position in the retort house. The gas which is passing from the retort can thus be seen burning 30 to 40 minutes later at the photometer; and a change in calorific value can be immediately investigated. Gas of a steady calorific value is at all times our ideal; and with

attention to the points enumerated, and strict observance of retort house conditions, stokers themselves find an interest in keeping a straight line on the chart. Further to help to nullify any discrepancy in calorific value which may take place in the supply to the district, all the gas made is led into the largest holder, and fed back into the smaller as the consumption demands.

At the introduction of vertical retorts, with which in our case a reduction of the calorific value of the gas was made, it was necessary to survey the distribution system. The change-over was made at an opportune time—viz., the middle of June. We were thus enabled at first to give full attention to cooking apparatus, and gradually deal with the lighting and heating appliances as the load came on. We were aware that portions of the town mains were requiring attention; work was commenced immediately. For some time we were engaged laying new steel mains and extending and renewing services. Now, at the most distant point from the works, we are able to maintain ample pressure. We are in the fortunate position of having our works at the lowest part of the town, and have no difficulty, with a works pressure of 30-10ths, in providing a pressure of 2 in. at the consumers' meters 1½ miles from the works, when the heaviest load is on. We have laid over 5000 yards of steel main ranging in size from 1½ in. to 4 in. diameter.

As road construction has been everywhere carried out extensively in Brechin, we took the opportunity of examining and, if necessary, increasing services and mains. All steel mains are of the spigot and faucet type, with lead joints. Nothing smaller than ¾ in. service is laid. Most services are taken from the side of the main with heavy brass couplings; and in the case of a short service (anything up to 12 or 15 ft.) lead pipe is used. Where there is a long run, galvanized tube of steam quality is installed. This is excellent, for there is less corrosion. Our distribution system also includes seven miles of steel main supplying high-pressure gas to a neighbouring village. As this main runs for nearly a mile through part of the town, we have utilized it to a fair extent for supplying various large consumers in the town. We boost at 60 in. with a Bryan Donkin compressor, and all high-pressure regulators are by the same firm. The system works perfectly.

Strict investigation of meter inspectors' reports helps at all times. Cookers are loaned free provided a certain amount of gas is consumed per annum, and they can also be had on the hire-purchase system. Gas fires and radiators are all hire-purchase, but every encouragement in the way of price is given for an outright sale. There are 2630 consumers; the average consumption per consumer being 17,000 c.ft. for ordinary, and 15,000 c.ft. for prepayment, meters. Since 1914 the number of consumers has increased by 330, and the annual make has risen from 30 to 48 millions—and this despite a decrease in population of nearly 16 p.ct.

I would here make a slight reference with regard to competition with electricity, and relate briefly what has been happening during the last few years in our city.

Electricity at Brechin.

The electricity supply was originally under an Order of 1898, granted to the Burgh of Brechin; and in 1900 a deed of transfer approved by the Board of Trade transferred the Order to a private company. The Order of 1898 allowed a maximum price of 8d. per unit, with a minimum charge of 13s. 4d. per quarter. From 1900 until 1914 the price ranged about 6d. per unit; and it was not until 1919 that the maximum price of 8d. per unit came into force. Then in 1920, under the Temporary Increase of Charges Act, the Company were granted an Order to charge a maximum of 1s. per unit for lighting, and a minimum charge of 15s. during the winter quarters, and 10s. during the summer quarters. From 1900 until 1919 competition was keen; but it was not until four years after this minimum charge had been adopted that the Electricity Company were able to pay a dividend, when their profit rose from £600 to £2000. Naturally the increase in price, and especially the minimum charge, did not find favour. A public meeting of protest was called, and subsequently an inquiry was held by the Ministry of Transport. One consumer giving evidence at the inquiry said he had paid £2 for four summer quarters, and consumed 16 units, so that he was paying at the rate of 2s. 6d. per unit. All this controversy and dissatisfaction brought us many consumers; a goodly proportion of them being shopkeepers. We have been able to convince them that gas as an illuminant is equal to electricity. As regards costs, with electricity at 1s. 5d. per unit, the majority of new consumers have halved their previous lighting bill. That gas for cooking and heating holds the field, no one will dispute.

Mr. Clark proposed a vote of thanks to the President.

Mr. Laing thanked the Association for the way in which they had supported him during his term of office.

Thereafter the members joined their lady friends at tea, following which an enjoyable whist drive and dance completed a successful meeting.

"Journal" Index.—The index to the "Journal" for the past quarter—January-March—is given as a supplement to this issue.

POWER ALCOHOL.

Production from Tuber and Root Crops in Great Britain.

As a fuel, alcohol possesses many advantages, perhaps the chief of which is that it allows the use of high compressions, up to 200 lbs. per sq. in. On the other hand its volatility is low, and consequently it is necessary to add a more volatile "livening agent." It does not mix freely with petrol, so that the latter is in this respect ruled out of court. It is, however, miscible with benzole in all proportions, and the resulting mixture is a highly efficient fuel. Every day one hears of the necessity for finding a substitute for imported petroleum products. Benzole is as good as, if not better than, petrol as a motor fuel; but the supply is by no means equal to the demand. It seems possible, therefore, that, if alcohol can be produced cheaply in Great Britain, the standard home-produced fuel of the future may be a benzole-alcohol mixture.

Alcohol from Potatoes.

For several years before the war, Germany produced large quantities of alcohol from potatoes specially cultivated for the purpose. The history of this German industry is comprehensively given in "Power Alcohol," by G. W. Monier-Williams. He points out that the success attained prior to the war was due not so much to actual cheapness of production as to the effect of State subsidies. If we can draw conclusions from continental experience, the cultivation of potatoes in Great Britain, with the object of producing power alcohol, would demand heavy subsidies, and would not, under present conditions, be economically practicable. It is significant that, before the war, 95 p.ct. of the alcohol produced in Germany was made from potatoes, while in 1920-21 only about 15·5 p.ct. was so made.

Work of the Fuel Research Board.

The Department of Scientific and Industrial Research (Fuel Research Board) have just published their Third Memorandum on "Fuel for Motor Transport," which is concerned with the production of power alcohol from tubers and root crops in Great Britain. In this pamphlet (obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 9d. net) it is stated that the only possible raw materials which could be grown in Great Britain and Ireland for this purpose are potatoes, mangolds, and Jerusalem artichokes. It is unlikely that potatoes could be grown at a price which would make it possible to obtain alcohol for use as an alternative to petrol at anything approaching its present price. Stated briefly, 1 ton of potatoes produces 20 gallons of 95 p.ct. alcohol, so that every £1 it costs to grow a ton of potatoes is equivalent to 1s. on a gallon of alcohol for raw material. A possible way in which alcohol might be produced for the purpose is suggested—viz., co-operation between the potato grower and distiller, the erection of small distilleries in the centres of growing districts, the combination of cattle rearing with potato cultivation so as to utilize the distillery residues for cattle feeding, and the use of the resulting manure on the land. The mangold possesses several advantages over the potato. It is an easier crop to grow, harvest, and store, and it is not so liable to disease and failure. Its carbohydrates, being in the form of sugar, simplify the manufacture of alcohol. It is, however, susceptible to injury from frost, and cannot be grown in the north of England or in Scotland. The yield of 95 p.ct. alcohol per ton, calculated on the average sugar content, is about 8 gallons; so that every £1 it costs to grow a ton of mangolds is equivalent to about 2s. 8d. on a gallon of alcohol for raw material. The average yield of mangolds per acre in Great Britain is, however, 19 tons, as against 5·7 tons of potatoes; and the price is about £1 10s. for the former as against about £7 for the latter on the wholesale market. If potatoes were used, the cost per gallon for the raw material would be 7s.; if mangolds, the cost would be 3s. 9d. The yields from Jerusalem artichokes vary from 15 to 25 gallons of 95 p.ct. alcohol per ton.

Tempering Springs by Gas.

An account of the installation of a continuous-process gas oven for tempering the springs of automobile seats was given some little time ago in the pages of the "American Gas Journal." For these seats helical coil springs are turned out in great quantities; but the wire used in the coils, after they have been formed, is too hard to be fitted in a seat, and to give service, without the coils flattening, and so it becomes necessary to resort to tempering. Immediately after being formed, the coils are packed on perforated metal trays (each tray holding 40 lbs. to 50 lbs. of wire coils), and carried in a continuous line on gravity conveyors to the tempering oven, to which they are transferred. The oven temperature is maintained at 500° Fahr. Direct gas burners with blast tips, operating at 1 lb. pressure developed by a Roots gas pump, are controlled automatically by Robertshaw temperature controllers. With two conveyors operating, the oven equipment accommodates 240 trays an hour, each holding 40 lbs. of coils, making a total of 9600 lbs. an hour delivered, or approximately 86,400 lbs. per nine-hour day. The heat treating time is 15 minutes.

CORRESPONDENCE.

Government Subsidies.

Sir,—With reference to the possible subsidy by the Government to electricity undertakings, it would appear that the utmost vision has not been utilized. As the gas industry is the chief conservator of our coal supplies, would it not be better to subsidize this industry for the purpose of expanding its production of aniline dyes, and thus enable the gas undertakings of the country to engage chemists on research work with a view to our equal efficiency with Germany in regard to dyes?

"Carboniferous."

April 17, 1925.

REGISTER OF PATENTS.

Regenerative Gas Furnaces.—No. 208,700

Huessener, K., of Pittsburgh.

No. 30,480; Dec. 4, 1923. Convention date, Dec. 21, 1922.

This invention relates to the regulation of combustion, and consists essentially in regulating apparatus wherein the air and gas are fed to the furnace through chambers connected to pressure-controlled mechanism. The latter regulates the supply of air and maintains the air and gas pressures inside the chambers at a constant ratio. A hand-controlled valve is provided in the air supply conduit between the air chamber and the furnace; this enabling the apparatus to be adjusted.

Gas-Fired Firetube Boiler.—No. 216,151.

Eickworth, R., of Dortmund.

No. 12,072; May 16, 1924. Convention date, May 16, 1923.

A single U-shaped firetube is used for heating the boiler; one of the two ends being provided at the front end of the boiler with a blade wheel burner, while the other end of the firetube is provided (also at the front end of the boiler) with a fan connected to the burner by gearing.

Coke Handling Plant.—No. 218,654.

Koppers Coke Oven Company, Ltd., of Sheffield.

No. 15,800; July 1, 1924. Convention date, July 5, 1923.

A method commonly adopted for handling coke from coke ovens consists in pushing the coke out of the oven into a car, then running this under a central quenching tower, and thence transporting the coke from the car to a screening plant by a conveyor. This invention relates to this system. In combination with an elevated storage bunker from which the screen can be fed is used an inclined chute below the bunker, delivering directly to the screen, so that the latter can be fed from the bunker or by the chute alternatively; the coke conveyor being arranged to deliver either to the inclined chute below the bunker, or to an inclined chute above the bunker. Under normal conditions the coke is delivered directly from the intermediate container to the bottom chute leading to the screen; but in the case of a stoppage at the screen, incoming coke is deflected to the bunker, whence it is delivered to the screen when convenient. Direct feed to the screen may proceed when the bunker is full.

Purification of Coke-Oven Gases.—No. 224,863.

L'Air Liquide Sté. Anyme pour l'Etude et l'Exploitation des Procédés Georges Claude, of Paris.

No. 18,793; Aug. 7, 1924. Convention date, Nov. 17, 1923.

By this process the carbon dioxide and sulphuretted hydrogen are removed from the gas by passing it through a column provided with Raschig rings through which an ammoniacal solution is circulated. This solution can afterwards be regenerated by passing it through a tower provided with plates in which it is subjected to a progressively increasing temperature sufficient to expel the carbon dioxide and sulphuretted hydrogen. Alternatively the solution may be distilled, and the ammonia evolved converted into sulphate.

Safety Cocks for Gas Burners.—No. 229,876.

Schar, F., of Schwechat, and Theumar, R., of Vienna.

No. 7182; March 20, 1924.

This invention relates to gas burners of the kind in which, as long as the burner is alight, the shutting-off member is retained in the open position by a flexible clamping device under the influence of the generated heat, but is automatically closed as soon as the burner is extinguished. According to this invention, a rod is arranged to move longitudinally between the burner and the outlet nozzle for the gas, the end of this rod which is near to the burner being attached to the clamping device, while the other end is so formed that it may be forced against the nozzle to close it.

Low-Temperature Carbonization.—No. 229,880.

Zuyderhoudt, P. C., of Brussels.

No. 7262; March 21, 1924.

The object of this invention is to provide an oven for producing continuously low-temperature coke in the form of cakes, and for recovering the distillates. An elevated ring oven is provided comprising a series of chambers each containing a battery of retorts and having means for connecting them with each other, with the outside air, and with a waste-gas flue. The chambers extend over a free space of a depth at least equal to that of the retorts. This is for discharging purposes. Discharge is effected by lowering the bottoms of the retorts. In operation the retorts are entirely surrounded by the heating atmosphere of the chambers.

Coke Ovens.—No. 230,167.

Mellersh-Jackson, W. J., of London.

(A communication from the Koppers Company, Ltd., of Pittsburg.)

No. 30,490; Dec. 4, 1923.

This invention relates to regenerative ovens with retorts alternating with heating walls containing vertical heating flues porting at their upper ends into horizontal distributing channels. The invention has for its chief object to permit a considerable reduction in the capacity of the latter channels, with corresponding increase in the effective heating area of the heating walls, while permitting the employment of the system of flow through the walls, wherein upflow in the vertical flues of one group takes place concurrently with downflow in the flues of another group in the same heating wall. A communication duct is located at a higher level than the retorts, and connects the horizontal distributing channel serving a group of upflow combustion flues with a horizontal distributing channel in the same heating wall and serving a downflow group of flues.

Wet Meters.—No. 230,175.

Thorp, F., and Parkinson and W. & B. Cowan, Ltd., both of Kennington, S.E. 1.

No. 30,619; Dec. 5, 1923.

This invention relates to wet gas-meters of the type wherein one or more oscillating liquid-sealed bells are coupled to a rocking lever or levers or other mechanism, and thus also to the gas distributing mechanism. The object is to ensure that operation of the meter shall be prevented should the liquid within the meter exceed a predetermined level.

There is provided an auxiliary valve upon a float-controlled stem which is closed to prevent a flow of gas when the liquid exceeds the predetermined level; and this auxiliary valve is mounted above and on the same stem as the ordinary stop valve.

Water Gas Production.—No. 230,217.

Whitwell, G. E., of Tacoma, Washington.

No. 966; Jan. 12, 1924.

This invention relates to a process of making water gas and to apparatus therefor.

According to the invention, part of the run is effected by passing a mixture of fresh gas-making steam and gas successively through a recuperating or superheating vessel or vessels and the entire fuel bed in the generator, and another part by steaming the entire fuel bed in the opposite direction. The run with fresh gas-making steam and gas preferably follows the blasting of the fuel bed and the up run of steam, and takes the place of the so-called down run of steam, which is expensive and wasteful through the steam of the customary down run not being superheated. The patentee further points out that the back run of steam and gas effected in accordance with his invention cleans the checker brick when oil is used, removing carbon deposit therefrom and increasing the yield of gas. The steam which passes successively through the superheating vessels and generator, produces gas; and a portion of this is repassed with steam through the vessels and generator, and forms, with the steam, the mixture of steam and gas above referred to. It is claimed that the invention decreases the cost of maintenance of the apparatus and permits the use of cheaper low-grade oils as the enriching material; further, that the generator be charged with other fuels than coke or anthracite.

The apparatus for carrying out the process above described includes a generator and a superheater or recuperator, and if desired a carburettor there-between; means being provided, including a device such as a jet, for causing a back run of gas through the apparatus. As in well-known gas-making plants, there is a main passage from the generator, through the superheating vessel or vessels, to a wash-box or the like. According to the present invention, a second passage is provided from the generator to the wash-box, these two passages having a by-pass connection with each other in which the steam jet is located, the by-pass preferably connecting with the main passage between the superheater and the wash-box, although it falls within the scope of the invention to connect this by-pass with the main passage at some other point.

After describing in detail the apparatus, the specification states that the act of recirculating the gas has a most important and beneficial effect upon the economical operation of the set in the manufacture of carburetted water gas.

First, a larger volume and weight of gases is passed through the superheater and carburettor than if steam alone were so passed, thereby transferring to the generator (where it can do useful work) heat contained in the superheater and carburettor otherwise wasted.

Secondly, when blue gas is passed a second time through the fire-bed, the carbon dioxide contained therein is afforded another opportunity to become reduced to the more valuable carbon monoxide.

Thirdly, the capacity of the machine is greatly increased. When steam reacts with incandescent carbon, two main reactions are possible according to the temperature and concentration of the reacting substances:

$$H_2O + C = CO + H_2$$
$$2H_2O + C = CO_2 + 2H_2.$$

The first of these two is the one most desired in making carburetted water gas. Maximum capacity, among other things, requires maxi-

mum passage of steam. The amount of steam possible to be used, however, is limited by a further reaction:

$$H_2O + CO = CO_2 + H_2.$$

Too much steam, therefore, results in the formation of carbon dioxide, so undesirable as to limit the amount of steam usable and, with it, the capacity of the set. Recirculation of considerable portions of the back run gas permits of the use of excess steam and the attainment of increased capacity, because carbon dioxide formed is later reduced to carbon monoxide by again passing through the fire-bed and coming in contact with incandescent carbon—thus:

$$CO_2 + C = 2CO.$$

Fourthly, inasmuch as in any water gas set steam in excess of that theoretically required must be used, there is always an excess of steam which passes undecomposed through the fire-bed. Recirculation, however, provides for a repassage of some of this steam through the fire-bed, thus reducing the amount of steam which must be supplied from the boilers.

Fifthly, there is a reaction between the superheated back run steam and recirculated back run blue gas, whereby carbon dioxide is formed from the carbon monoxide of the blue gas. This reaction may take place either in the superheater or in the carburettor, or in both, before the gases reach the generator; thus:

$$CO + H_2O = CO_2 + H_2.$$

The carbon dioxide formed is later reduced to carbon monoxide by passage through the fire-bed. Because of this reaction, however, the gas-making portion of the set is thereby increased to include the carburettor and superheater as well as the generator, thus increasing the capacity of the set.

Washer-Scrubbers.—No. 230,243.

Kirkham, Hulett, & Chandler, Ltd., Hersey, S., and Stokes, F. W., all of Norfolk Street, W.C. 2.

No. 3427; Feb. 9, 1924.

This invention provides for a modified design of the well-known apparatus wherein bundles of metal plates are arranged between a pair of circular end or cover plates. The object of the modification is to increase the rigidity of the rotating members, to facilitate the carrying of wider bundles, providing increased washing area, to provide for the easy removal of the bundles for cleaning, and generally to reduce the cost of manufacture.

To this end, each bundle is mounted in a framework carried by a hub on the driving shaft in such a manner that the end plates of each bundle are sealed in the framework, thus avoiding the use of end or cover plates.

In a suitable construction, the framework is built up of a series of T bars extending radially in pairs from the driving hub. The periphery of the latter is advantageously made polygonal or with flats, and the pairs of bars extend from the angles at the lines of intersection of adjacent flats, being so placed that the webs of the bars of each pair extend inwardly in the same radial plane and their flanges lie in the outer face of the framework. These radial bars are rigidly connected by circumferential bars or strips attached to adjacent flanges on each face or side of the framework.

Alternatively, the framework may be built up of a series of flat bars, instead of T bars, extending radially in pairs from the driving hub. In this case the two outer plates of alternate bundles of plates are preferably made wider than the inner plates, so that they overlap the outer plates of the adjoining bundles where they make contact with the bars.

The casing of the apparatus is advantageously of rectangular form in cross section, and the flat top thereof can serve as the bottom of a tank for water for cooling the casing.

Carbonization.—No. 230,281.

Imray, O. Y., of London.

(A communication from S. P. Curtis, of Philadelphia.)

No. 7502; March 24, 1924.

The process is for the manufacture of hard low-volatile coke, and gas of relatively high calorific value, together with the recovery of oils. It consists in heating the coal in a chamber having a centre take-off duct; causing the liquids, gases, and vapours evolved at the low temperatures to travel through the coolest portion of the material in the chamber and escape therefrom before they can undergo secondary decomposition; carbonizing at a high temperature the coked residue; maintaining a plastic film in the body of material in the chamber, which separates and protects the liquids, vapours, and gases escaping through the coolest portion from the high temperatures used to carbonize the coked residue, and from contact with the high-temperature gases evolved from this coked residue; and causing the high-temperature gases to escape freely through an outlet distinct from the one through which the low-temperature products escape.

Gas Cookers.—No. 230,506.

Helps, G., of Nuneaton.

No. 22,673; Sept. 10, 1923.

By this invention the flue pipe from the outlet nozzle of the cooker is brought down to a level just above the burners in the oven, or below them, as experience with a particular oven proves necessary. Such an arrangement, claims the patentee, balances the pressure inside and outside the oven. The waste occasioned by the oven being open at the bottom is neutralized, as the pull on the outside air would only be that measured by the difference in the levels of opening and the flue pipe end. Instead of bringing down the flue pipe as described, an orifice may be made in the closed bottom, which will answer the same purpose.

Geysers.—No. 230,525.

Gausden, A. H., of Wallington.

No. 28,936; Nov. 16, 1923.

This invention relates to geysers of the instantaneous hot water type, and has for its object an improved construction whereby water is caused to flow by pressure up the jacketed sides of the geyser, and then by gravity over a number of flat spirally corrugated metal plates in a zig-zag manner.

Gas Meters.—No. 230,582.

Anderson, J., of Edinburgh.

No. 867; Jan. 11, 1924.

This invention relates to valves for prepayment gas meters. During and since the war, states the patentee, difficulty has arisen with the operation of meters owing to the fact that the gas contains more matter in suspension than previously, causing the deposition of grit on the valve and its seating, preventing full closure. The object of the invention is to overcome or minimize this difficulty. The invention consists in the employment of a valve of a rotating or sliding type—as distinct from the usual form of valve—preferably one comprising a cup or disc with a ground face mounted on a pivoted arm and capable of being moved over the ground face of a port with a guiding extension.

No. 230,583.

No. 868; Jan. 11, 1924.

This invention relates to prepayment mechanism, and its object is simplification. It consists in measuring-out mechanism comprising a pair of gear wheels mounted on different axes; the smaller operated from the prepayment mechanism, and the larger carrying, or controlling, means (such as a further wheel) for effecting control of the valve by a screw acting both as a rack and also as a worm, and in addition operating an indicator.

Gas Burners.—No. 231,115.

Helps, G., of Nuneaton.

No. 529; April 7, 1924.

By this invention the adjustment of the air to atmospheric burners may be regulated automatically. A gas burner is provided with means whereby the turning of a tap partially to shut off the gas causes the partial closing of a restricted passage in the plug, which passage acts as the injector nipple.

APPLICATIONS FOR PATENTS

[Extracted from the "Official Journal" for April 8.]

Nos. 8383-9057.

Brown, F. A.—"Gas supply indicator and regulator." No. 8569.
Davidson, W. B.—"Distillation of tar, &c." No. 8716.
Fisher, H.—"Gas cookers, &c." No. 8541.
Humphreys & Glasgow, Ltd.—"Manufacture of water gas." No. 8629.
Kirkham, Hulett, & Chandler, Ltd.—"Apparatus for effecting intimate contact between liquids and gases." No. 8636.
Koller, K.—"Pressure-gas producers." No. 8825.
Michie, A. C.—See Davidson, W. B. No. 8716.
Muddiman, E. W.—See Davidson, W. B. No. 8716.
Shaw, J. F.—"Retorts for heating coal, &c." No. 8488.
Soc. l'Air Liquide, Ste. Anyme pour l'Etude et l'Exploitation des Procédés G. Claude.—"Distillation of coal." No. 8838.
Stokes, F. W.—See Kirkham, Hulett, & Chandler, Ltd. No. 8636.
Tormin, R.—"Manufacture of fuel from coke." No. 8849.
Weir, Ltd., G. & J., and Weir, J. G.—"Combustion of fuel and utilization of products of combustion in power production." No. 8887.
Zack, M.—"Gas retorts, &c." No. 8614.

[Extracted from the "Official Journal" for April 16.]

Nos. 9058-9590.

Aldridge & Ranken, Ltd.—"Tipping-apparatus for unloading coal wagons." No. 9372.
Ashley, T. J.—See Aldridge & Ranken, Ltd. No. 9372.
Bauer, H.—"Gridwork for gas scrubbers, coolers, &c." No. 9508.
Conlay, C.—"Retort lids." No. 9540.
Hansford, J.—"Prepayment gas meters." No. 9164.
Rombach, P.—"Gas meters, &c." No. 9386.
South Metropolitan Gas Company.—See Conlay, C. No. 9540.
Wilderspin, G. H.—"Gas retort furnaces." No. 9195.

Profit-Sharing.—At a conference of directors, managers, foremen, and forewomen held at Oxford last week, Mr. Duncan Todd, a Ministry of Labour official, said that the gas industry was the only one in this country which had been largely reorganized on a co-partnership basis; and the success attained had been mostly due to the strenuous advocacy of the principle by Sir George Livesey and his successors as Chairmen of the South Metropolitan Gas Company.

A Loss at Conway.—The accounts of the Gas Department of the Conway Town Council show a surplus of £2724 8s. 7d. on the revenue account, but after meeting redemption and interest on loans this was converted into a loss of £737 7s. 8d., which increased the deficiency to £11,893 4s. 8d. The balance-sheet shows that £56,029 1s. 2d. was expended on the works, and including the amount overspent up to date shows an excess of assets over liabilities of £14,967 16s. 6d. The make of gas per year has increased from 13,391,000 in 1899 to 56,111,000 c.ft. in 1924, and the gas produced per ton of coal has increased in the same period from 8058 to 12,692 c.ft.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following notices have appeared in the "London Gazette" regarding applications to the Board of Trade under the Gas Regulation Act.

SPECIAL ORDERS.

Midhurst Gas Company, Ltd.

An Order under section 10 is to be applied for by the Company to authorize them to use scheduled land for gas purposes, to supply gas in various parishes, to make provisions as to capital, to prescribe gas prices and rates of dividend, and to formulate regulations regarding the supply of gas.

Southampton Gas Light and Coke Company.

The Company are applying to the Board of Trade for a Special Order to extend the limits of supply, to increase the maximum rates of dividend and borrowing powers, to authorize the establishment of a co-partnership scheme, to make further provisions with regard to the issue of capital and the supply of gas, and for other purposes.

METROPOLITAN GAS COMPANY OF MELBOURNE.

The half-yearly meeting was held at the offices of the Company, Flinders Street, Melbourne, on January 28—Sir JOHN GRICE (Chairman) presiding.

The CHAIRMAN said that the cost of coal for the half-year amounted to £305,951.

The revenue from the sales of gas—£659,647—showed a decrease of £2677 in comparison with the corresponding period of 1923, due to reductions in the price, which was now 6s. 8d. per 1000 c.ft.

The total quantity of gas sold during the half-year was 1964 million c.ft., as compared with 1819 millions during the corresponding half of 1923—an increase of 8·01 p.ct.

From residuals the receipts were £150,204—an increase of £9556 over the corresponding period in the previous year. The operations of the stove and fittings department again showed very satisfactory results. Special efforts, by means of suburban cookery demonstrations and canvassing in various suburbs to increase the use of gas cooking stoves, had resulted in an output of these for the year of 8651, as compared with 7838 last year. Sales of other appliances had met with a good response.

The number of meters fixed at Dec. 31 was 168,928, as compared with 166,513 at the same date last year. The profits for the half-year under review amounted to £138,677, from which sum transfers of £41,763 had been made to the reserve fund, £5000 to the meter renewal fund account, and £10,000 as a nucleus of a staff superannuation fund, leaving a balance of £81,914. It was recommended that a dividend at the rate of 7s. 6d. per share be declared, absorbing £82,197, leaving an amount to be carried forward of £71,778.

During the half-year 14½ miles of service mains and nearly 4 miles of trunk mains were laid, in addition to 57 miles of services.

The continuous vertical carbonizing units at the West Melbourne Works, as recently improved, continued to give the greatest satisfaction.

At the last half-yearly meeting they were informed that the Directors were issuing 20,000 new shares of £5 each. Of these, 14,824 were disposed of for an amount of £107,566 15s.—an average of £7 5s. 1·5d. per share. The balance of 5176 shares unsold at the auction were offered to shareholders as follows: In the Commonwealth, 4387; in Great Britain, 789. At the upset price of £7 5s. per share, the whole of the 4387 shares offered to Commonwealth shareholders were taken, the amount received being £31,805 15s. Of the 789 shares similarly offered to English shareholders, 342 were accepted, leaving a balance of 447, which were disposed of in Melbourne in November last for £3479 7s. 6d.—an average of £7 15s. 8d. per share. The total net premium received from the issue, after payment of all expenses, including printing, brokerage, and advertising, was £43,527, which was credited to premium capital. Debentures to the amount of £38,000 at 4 p.ct. fell due on Oct. 1, and the Directors decided to issue a conversion loan of 6½ p.ct. debentures at £98 10s., with a currency of eleven years. Holders of the maturing debentures converted to the extent of £15,700, the balance of £22,300 being subscribed by the public. The Company had considerable commitments which might render it advisable to make a further issue later in the year.

Mr. G. S. ALLEN moved: "That a dividend at the rate of 7s. 6d. per share for the half-year on 218,386 shares, and at the rate of 3s. 9d. on 1614 shares issued on Oct. 1, 1924, be declared."

Mr. J. WALKLATE seconded the motion, which was agreed to.

Newtownards Gas-Works Loan.—At a Ministerial Inquiry into the application of Newtownards Town Council for sanction to borrow £6000, and to have a running overdraft of from £8000 to £10,000 funded as a loan, the Town Clerk said the loss on the gas undertaking was occasioned by war conditions, &c. For the year ended March 31, 1919, the loss was £2386; 1920, £1977; 1921, £1807; and 1922, £3016. The concern had been holding its own for the last two years. Mr. John P. M'Ilwaine (the Gas Manager) gave evidence as to the consumption of coal for the years 1919 to 1923, and detailed the cost of production and distribution of gas; pointing out that the loss, in a large measure, was due to the small consumption, particularly by the factories, which had given up the use of gas engines and installed crude-oil engines as a cheaper means of driving their machinery.

THE AUSTRALIAN GAS LIGHT COMPANY'S WORK AND PROGRESS.

From a Souvenir Booklet.

The history of the gas industry in New South Wales extends over the reigns of five monarchs of England, for, as far back as the days of King George IV., the pioneers of Sydney considered lightening the gloom of their straggling streets by the then newly discovered illuminant—gas. Their consideration took definite form in the reign of the next Sovereign, William IV. In 1837, just prior to Queen Victoria's accession to the Throne, a quaintly worded Royal Charter gave power for the formation of the Australian Gas Light Company, for the purpose of "effectually lighting the said town of Sydney." At that time the entire white population of the infant Colony of Australia numbered only 150,000, but what the pioneers of Sydney lacked in numerical strength they more than made up in courage and enterprise. They launched the first gas company in Australia only twenty-five years after the incorporation of the first in the world—now the Gas Light and Coke Company. The gas undertakings of Paris and Berlin came into being a few years earlier than that of Sydney.

To celebrate the birthday of Queen Victoria, May 24, 1841, the streets of Sydney were first lighted with what the Press of the day, in its enthusiasm, described as "this exquisite production of science . . . this pure, brilliant, and inoffensive illumination of gas."

Literally, the Australian Gas Light Company was founded upon a rock, the sites for the first works, gasholder tanks, and offices being actually hewn out of the solid sandstone at Darling Harbour. Each of the first two holders had a capacity of 45,000 c.ft., which the Directors of those days referred to as "being sufficient to store up a superabundant stock of purified gas to meet any emergency, the 90,000 c.ft. of storage being considered more than adequate for all the wants of Sydney for many years to come." How far along the road of progress the Company has advanced since then is shown by the fact that it now has five holders with a total capacity of nearly 20 million c.ft., one of which is the third largest in the world, while during the last fiscal year no less than 406 million additional c.ft. of gas had to be made. The make of gas now reaches an annual total of just on 7000 million c.ft.

From the small concern of the early 'forties, the Company has grown to be the seventh largest gas undertaking in the British Empire, while it is rapidly overhauling the gas companies of the great cities of Manchester and Liverpool for the honour of fifth position.

New South Wales is blessed with a wealth of coal, but that wealth must be conserved. The Australian Gas Light Company is in line with the gas industry generally in the economical utilization of the world's coal resources. Recognizing the national need for extended use of gas as a substitute for the wasteful burning of coal, the Company is encouraging gas utilization by the introduction of concessions in price and the provision of a special demonstration hall. This is equipped with up-to-date furnaces and appliances for the convenience of manufacturers desirous of making practical experiments, under actual working conditions, in the use of gas as an industrial fuel. Manufacturers find in the cheap rates for industrial gas a solution of one of their greatest economic problems, and they welcome the opportunity given by the Company to test its possibilities.

By the original Royal Charter of 1837 the capital of the Company was limited to £100,000, but this restriction was removed by subsequent legislation. To-day capital stands at nearly 4½ million pounds sterling, which has been contributed by over six thousand share and debenture holders, most of whom are actual customers of the Company. A big percentage of the employees are also shareholders, a fact which gives them a personal interest in the organization which they serve. With the shares of the Company spread over so great a number of stockholders, and with the customers and staff taking part in the financing of the concern, the Australian Gas Light Company is a co-operative organization in the true sense.

The Company, in its works, out-stations, branches, and head office, employs 3000 people; the wages and salary bill amounting to well over £800,000 per annum. The relations between the Company and its employees are harmonious, which is due in great measure to the smooth working of the conciliation systems in operation. This happy condition of affairs has been more marked since 1920, when an agreement was completed between the Company and the Gas Employees' Union, which represents the main body of the workers. This agreement was the basis for a system of conciliation unique in the industrial history of the Commonwealth; all disputes and labour difficulties now being settled in an atmosphere of reason around the table of the Conciliation Committees. The success achieved by these Committees has been remarkable.

A keen interest is taken by the Company in the educational efforts of its staff; and fees are advanced for tuition in approved commercial subjects. An extensive welfare scheme has been inaugurated, and is enthusiastically supported by the staff. Comfortable rest and luncheon rooms, medicine chests, nursing attention, and facilities for social functions are provided, under the care of a Committee elected by the staff from among its members.

Winchester Preference Stock Over-Subscribed.—An issue by the Winchester Water and Gas Company (which was made locally) of 5½ p.ct. preference stock has been largely over-subscribed—practically all those tendering at par having to remain unsatisfied. Announcing the result, a Winchester paper says: "That the stock in a local undertaking should command such attention must be very gratifying to the Directors and stockholders, and is evidence that it is widely realized that the citizens of Winchester are well served in their water and gas supplies."

COLOMBO GAS AND WATER COMPANY, LIMITED.

Annual General Meeting.

The Annual General Meeting of the Company was held at the Offices, No. 148, Gresham House, Old Broad Street, E.C., on Monday, April 6—Mr. Strachan C. Clarke (Chairman) presiding.

The Secretary (Mr. A. C. Pullen) read the notice convening the meeting and the Auditor's report.

The Chairman: Gentlemen, a copy of the report and statement of accounts having been sent to all the shareholders, I will ask you to take them as read. One of the Directors, Mr. Robert H. Glen, is not able to be with us to-day, as he is now on his way to the East, and will be at our Colombo Works on the 18th inst. During his stay in Ceylon, he has undertaken to report to the Board as to land which may be available, as we should be prepared for future extensions.

I am pleased to state that the total gas sold during the year was 13·5 p.ct. more than in 1923; the private consumption being equal to 82 p.ct. of the whole. To encourage the use of gas for cooking and heating, we arranged last year a specially low rate for same; and at the end of August a scheme was started for fixing cookers entirely free to consumers—a moderate rental being charged for the cooker itself. At our last annual meeting I referred to the fact that the Ceylon Government had passed the hydro-electric scheme, and the work of construction is now proceeding. It is therefore very necessary for this Company to obtain all the trade it possibly can in gas for heating, and no effort to that end is being spared. The total number of cookers in use at Dec. 31 last was 423, compared with 209 at the end of 1923; so we have doubled the number in one year.

The alterations and extensions at our works have been completed; and, as we have now sufficient plant to meet the gas requirements of Colombo for very many years, we hope business will continue to forge ahead rapidly. An amount of £14,906 has been added to capital account in connection with extensions, and £4000 has been appropriated from the retorts reserve for the renewals and replacements. The walls and roof of the old retort house were taken down, and the building was reconstructed; fresh retorts and mouthpieces being supplied for old beds. Reference to the capital account will show also that we paid off debentures amounting to £3800 during last year. A few further bonds were paid off on Jan. 1 last, and debentures amounting to £3300 fall due on July 1. These will be repaid, and the Company's total debenture debt will then amount to only £3950; the bonds being met as they mature.

We carbonized 679 tons of coal more than in 1923, but the total cost for coal is somewhat less. The average rate per ton for 1925 will show a further considerable diminution, and reductions in the gas rates consequently came into force as on the 1st inst. at Colombo. The average of gas made per ton for the year was 14,513 c.ft. of 450 B.Th.U.; and these figures, produced as they are from Indian coal and with native labour, are highly satisfactory, and reflect the greatest credit on our Manager. I may say that the make per ton for February this year was 16,666 c.ft. We hope to show an average make for the whole of the year considerably in advance of the 1924 figures.

The total for wages and salaries is about the same, and includes the bonuses paid on profits to all local employees from the Manager to the lowest workman. The Directors attach much importance to this profit-sharing arrangement. Maintenance of works and plant is slightly higher. We paid in 1923 for two new motor lorries, but in 1924 there was more expenditure on the works. Maintenance of mains shows a figure of Rs. 20,334, which is not a high cost. The total mileage of mains is 106. Trade charges was rather more; but the cost of advertising, included in this account, went up from Rs. 1583 to Rs. 6841, partly counterbalanced by the fact that we received considerable sums for the use of the Company's weighing scale, which moneys are credited to trade charges. Our Manager pays particular attention to the work of propaganda, and specimens of our advertisements and pamphlets are about these rooms.

On the credit side of the revenue, I would point out that gas rentals improved by Rs. 33,740. The quantity of gas sold private increased by 14 millions, and public by 2¾ millions; these increases in sales being offset to some extent by the reduction in prices. The revenue from residual products was considerably higher; coke sales being increased by 770 tons, and tar sales by 31,574 gallons. The net coke available for sale amounted to 9·93 cwt. per ton—a most satisfactory feature of our working. The percentage of the value of residuals on cost of carbonizing material for last year was 81 p.ct. Gasfittings account showed improvement. We made additional profit on the erection of new arc lamps, brackets, &c. Exchange account shows a credit arising from adjustment of remittances and shipments. I would point out that our assets remain in the books at 1s. 4d. per rupee, although the rate on Dec. 31 was over 1s. 6d. I think these are all the comments needed on the accounts.

The balance of net revenue is £28,509 17s.; and the Directors recommend a final dividend of 3½ p.ct. on the preference shares, less tax, and a final dividend on the ordinary shares of 5 p.ct., free of tax, also that £10,000 be added to the general reserve. Here I would remark that, from advices just received, the output of gas at Colombo for the past three months increased by 11¾ p.ct., the gas made per ton averaged 16,153 c.ft., and the rupee profit showed improvement.

I now come to a matter which has been engaging the attention of the Directors for some considerable time. Our general reserve account, after adding the £10,000 now recommended, will amount to £35,433; and we have other reserves. Investment account stands in our books at £42,693, and if the bank loan of £12,500 be deducted there is a credit balance of over £30,000; so that our financial position is very satisfactory. For some time the Directors have felt that the Company's proprietors, who in years gone by waited so patiently for a fair return on their shares, should benefit by our present position; and the Board recommend that bonus shares be issued to the ordinary shareholders at the rate of one bonus share for each three ordinary shares held. We have also decided to ask your acceptance of new Articles of Association, in order that our shares may be officially quoted on the Stock Exchange. The Committee will not, at present, sanction the request for a quotation, on the ground that our Articles are out of date. As the Company was established in 1869, we can well understand this view. We further consider that the ordinary shares should be converted into shares of £1 each, from the present figure of £10 each. Extraordinary meetings will be called shortly to place these proposals before you in detail, and to ask you, if thought fit, to give effect to same.

Before I sit down, I wish to again refer to Mr. Johnson, our present Manager. I have already mentioned, among other features of our working, the carbonizing results obtained last year; and the Directors are in every way most pleased with everything that Mr. Johnson is doing for the Company. He does not spare himself, and it is right that I should draw your particular attention to what he is doing for us. With these remarks, I have pleasure in moving that the report and accounts be received and adopted.

Mr. John G. Wardrop seconded the resolution.

Mr. Alfred W. Oke remarked that the shareholders fully appreciated the policy of the Board, and were pleased with the results of same.

Mr. A. J. Kingdon said that the Directors were to be congratulated in being able to bring forward such an excellent report and accounts. Much praise was due to the Engineer at Colombo for the very able manner in which he had managed the affairs of the Company there; also to the Secretary in London for the keen manner in which he undertook his duties. In obtaining over 81 p.ct. of cost of coal from residuals, the Engineer had recorded a result rarely heard of, even in England. This also indicated that the Board had been well advised in the purchase of coal.

The Chairman then put the motion to the meeting, and it was carried unanimously.

The Chairman moved the following resolution—viz.:

> "That a dividend for the year ended Dec. 31, 1924, at the rate of 7 p.ct. per annum upon the preference shares, less income-tax, and 10 p.ct. per annum upon the ordinary shares, free of income-tax (both less interim dividend paid on Oct. 1, 1924), be and is hereby declared, the warrants to be payable on April 17."

This was seconded by Mr. John G. Wardrop, and carried unanimously.

The Chairman then proposed the re-election of Mr. Robert H. Glen as a Director, which was seconded by Mr. Alex A. Johnston, who remarked on the great value of Mr. Glen's services to the Board. Mr. Johnston said that, although he personally had only been on the Board a short time, he could see that the Company's position was due to able direction and management. The future prospects were good, and the time was ripe for the issue of bonus capital referred to by the Chairman. Even after the addition to capital account of a further £20,000 ordinary shares, the Company's capital per million c.ft. of gas sold would compare favourably with that of English companies of a similar capacity.

The motion was unanimously carried.

Major Heriot R. Glen proposed the re-election of Mr. William Cash as Auditor for the current year, which was seconded by Mr. A. J. Kingdon, and carried unanimously.

The Chairman proposed a vote of thanks to the staff in London and Colombo. He said the Company's present position was largely due to the hard work of the Secretary, who was of the greatest assistance to the Board. He could add no more as to the Manager, except to say that Mr. Johnson was coming home this year on leave, and might visit England more often than in the past.

Mr. A. J. Kingdon said he wished cordially to second the motion, which was carried unanimously; and the Secretary briefly responded.

Mr. Alfred W. Oke proposed a hearty vote of thanks to the Chairman and Directors, and remarked that the Chairman had given shareholders some very welcome news. The Company was progressive, and was very competently managed.

Mr. H. Gage Edwards seconded the resolution, which was unanimously carried, and the proceedings then terminated.

Riscavoid.—This is the title of a Company registered, with a capital of £500, to acquire inventions relating to a device for the automatic closing of gas ducts when the supply of gas ceases or falls below a predetermined pressure.

New Capital for Littlehampton.—To provide the necessary extensions to cope with the growing demand for gas, the Littlehampton Gas Company require further capital; and accordingly Messrs. A. & W. Richards have been instructed by the Directors to offer for sale by tender £5000 of 6 p.ct. redeemable debenture stock, at the minimum price of par. Tenders must be received by the firm at No. 37, Walbrook, E.C., by Tuesday morning, April 28.

Price of Gas at Dunfermline.—A possible rise in the price of gas during the current year, in view of the fall in the value of residuals, was hinted at recently in the Dunfermline Town Council; but a statement made at last week's meeting showed that after all there would be no need for this. The Convener of the Gas Committee (Mr. Smith) announced that they had just completed the purchase of 20,500 tons of coal for the year, at an average cost of 19s. 7d. per ton, or 5s. 2d. less per ton than the previous year's supply. He was of the opinion that at the price mentioned the decrease of revenue from residuals would be balanced by this saving, and therefore the price of gas would remain at 2s. 6d. per 1000 c.ft.

The Team By-Product Coke Company.—The Company experienced a setback in the year ended Nov. 30, 1924; a loss of £40,107, after providing for taxation, being recorded, as compared with a profit of £52,501 for the previous year, and a loss of £31,595 for 1921-22. The Directors state that the economic dislocation on the Continent, which resulted largely from the Ruhr occupation, prolonged the severe depression in the iron trade, and caused during the year a disastrous reduction in the demand for coke. As a result, it was impossible to keep the Company's works fully employed; and the average production over the whole year was equal only to 70 p.ct. of the normal output. Since the end of the financial year the volume of business has increased, and the works are now on approximately full output.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The market returned to business after the Easter break without finding any improvement in conditions. Many of the collieries which are working have fairly full turns for a week or so ahead; but forward inquiry does not show any signs of developing, and the outlook for the end of the month and later is as bad as ever.

At the end of last week it was stated that 75 out of scarcely 200 pits in Durham had been closed entirely, and 40,000 men were idle. In addition to this, there are thousands who are working short time. Orders continue to go to Germany, at prices from eighteenpence to three shillings a ton below English quotations.

Durham gas coals are in poor demand, like all other sorts. Wear Specials are nominally 20s. f.o.b., and best qualities 19s. 6d. to 19s. 9d. They are fairly steady at these prices for prompt; but they can probably be discounted for forward business. Seconds and others are weak, and some makes obtainable at 16s. 9d., though nominal quotations are 17s. to 17s. 3d. The market for coking sorts is lifeless, and prices are 17s. to 17s. 6d. Unscreened bunkers are 17s. to 18s. 3d., according to quality.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

There is no appreciable difference in the coal market conditions in Yorkshire and Lancashire as compared with recent weeks.

Gas coals move steadily under contract, with indications of slightly decreased prices for renewals.

House coal remains steady, and there is no indication that prices will be lower in the near future.

The industrial situation does not improve, and "spot" lots of the lower-grade fuels are available at prices below the average; but these are not being taken advantage of, owing to the difficulty of dealing with contract supplies to which the consumers are already committed.

The slump in export continues, and it is questionable when the position will improve.

Prices at Hull at the week-end were (f.o.b. usual shipping ports): South Yorkshire: Hards, Association, 19s. 6d. to 20s. 3d.; screened gas coal, 19s. to 19s. 6d.; washed trebles, 20s. 6d.; washed doubles, 17s. to 17s. 6d.; washed singles, 17s. to 17s. 3d.; washed smalls, 13s. to 14s.; unwashed doubles, 15s. 9d. to 16s. 3d.; rough slack, 10s. 10½d. to 11s. 6d.; smithy peas, 20s. to 20s. 6d. West Yorkshire: Hartleys, 17s. to 18s.; screened gas coal, 18s.; washed trebles, 18s. to 19s.; washed doubles, 17s.; washed singles, 16s.; washed smalls, 12s. 6d. to 12s. 9d.; unwashed trebles, 18s.; unwashed doubles, 13s. to 14s.; rough slack, 11s.; coking smalls, 10s. to 11s. Derbyshire and Notts: Top hards, 19s. 3d. to 20s.; washed trebles, 18s.; washed doubles, 17s. 6d. to 18s.; washed singles, 17s.; washed smalls, 13s.; unwashed doubles, 15s.; rough slack, 10s. 6d. to 11s. Yorkshire, Derbyshire, and Notts: Screened steam coal, 15s. to 17s. 6d.; gas coke, 21s. to 23s.; furnace coke, 17s. 3d. to 18s. 6d.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

Output is being further curtailed. The suspension of coal-getting during the Easter holidays has helped to relieve stocks at some of the collieries, but not to any very appreciable extent, inasmuch as industrial consumption has been on a much reduced scale, and comparative idleness has reigned in the distributive channels. In no direction is there any strain on transport. Values have naturally tended to depreciate. Old undertakings that are linked, so far as the regulation of wages is concerned, with more profitable properties which have a superior geographical position are in many cases drifting into a hazardous plight. There are grave misgivings with regard to not a few of them. The prickly subject of the seven-hour day is generally avoided in public discussion of the crisis; but it figures very prominently when possible remedies are being canvassed in circumstances which impose less restraint. Thoughtful men among the miners appreciate as thoroughly as anybody does the importance of lowering the cost of production, and it is believed that many of them would be ready to acknowledge the part which the output per man has to play in any solution of this side of the problem.

Cokes are increasingly plentiful. Some of the big gas-works which have been very sure of their grip of the market, and have been adamant respecting proposals to lower district prices, are showing anxiety to cultivate both the industrial and the household trades; the advance of the season aggravating their difficulties.

TRADE NOTES.

"Thermix" Air Heater and Emile Prat Mechanical Draught Systems.

Messrs. James Gordon & Co., Ltd., of Windsor House, Kingsway, London, W.C., are acting as successors to the late Major S. Utting for the sale of the "Thermix" air heater and Emile Prat systems of mechanical draught.

Meldrums' Gas Purification Plant.

Messrs. Meldrums, Ltd., of Timperley, near Manchester, have received an order from Canada for their gas purification plant. The order includes their improved patent gas washer-scrubbers (in duplicate), capable of dealing with 12 million c.ft. of gas per diem.

Falk Stadelmann Gas Cookers.

We have received from Messrs. Falk, Stadelmann & Co., Ltd., of Farringdon Road, London, E.C., a copy of their 1925 list relating to gas cookers and other cooking requisites It deals with a large number of appliances for this important part of the business of gas undertakings.

The Davison-Waller Water Gas Plant.

Messrs. Davison & Partner, Ltd., of No. 11, Carteret Street, Queen Anne's Gate, London, S.W. 1, have forwarded a copy of their March booklet, which deals with the Davison-Waller water gas plant. It is of interest to mention that, since the publication of this brochure, repeat orders have been received from York, Dorchester, and Ashford.

Dixon's Silica-Graphite Paint.

The Joseph Dixon Crucible Company, No. 22, Duke Street, Stamford Street, London, S.E. 1, have published a new descriptive booklet about their silica-graphite paint. This paint, it may be mentioned, has been supplied in all parts of the world for over 55 years, for the protection of iron and steel structures, &c. It is now being manufactured in England by Mr. C. R. Averill, at the above address.

"A. & M." Pressure-Wave Controllers.

The County of Lanark, District of Middle Ward, have placed a contract with Messrs. Alder & Mackay, Ltd., of New Grange Works, Edinburgh, for a complete installation of "A. & M." patent pressure-wave controllers, to be fitted to all the public gas lamps coming under the Bellshill and Mossend special lighting district. This installation will represent 500 lamps, and will be operated from the Bellshill Gas-Works. The work is to be completed in readiness for next lighting season.

CONTRACTS OPEN.

Coal.

The East Dereham Urban District Council are inviting tenders for a twelve months' supply of screen gas coal or nuts. [See advert. on p. 266.]

Tenders are invited by the Gas Committee of the Todmorden Corporation for the supply of 10,000 tons of gas nuts. [See advert. on p. 266.]

The Thornton Urban District Council are asking for tenders for about 3000 tons of best screened gas coal, nuts, or slack, and 300 tons of steam burgy. [See advert. on p. 266.]

EXTENSIONS.

New Holder for Troon.

At a meeting of the Dean of Guild Court, Troon, on Tuesday of last week, the plans of a new gasholder on the north shore were passed, and the erection of same authorized. The estimated cost is £14,550.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 20.

There is a moderate amount of inquiry for pitch, and the price is nominal at about 41s. to 42s. per ton f.o.b. works.

Creosote is quiet at about 7⅛d. to 7¼d. per gallon net and naked at works.

Pure benzole and pure toluole are about 1s. 10d. per gallon; and solvent naphtha, 95/160, about 1s. 8d. per gallon.

Tar Products in the Provinces.

April 20.

The average values for gas-works products during last week were: Gas-works coal-tar, 28s. 6d. to 33s. 6d. Pitch, East Coast, 40s. to 41s. f.o.b. West Coast—Manchester, 35s. to 36s.; Liverpool, 36s. to 37s.; Clyde, 39s. to 40s.; Benzole, 90 p.ct., North, 1s. 6¼d. to 1s. 7¼d.; crude, 65 p.ct., at 120° C., 10d. to 1s., naked at makers' works; 50-90 p.ct., naked, North, 1s. 6¼d. to 1s. 7¼d. Toluole, naked, North, 1s. 6¼d. to 1s. 7¼d., nominal. Coal-tar crude naphtha, in bulk, North, 7¼d. to 8¼d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 1s. to 1s. 2d. Creosote, in bulk, North, liquid, 6⅛d. to 6⅜d.; salty, 6d. to 6¼d.; Scotland, 5⅝d. to 6⅛d. Heavy oils, in bulk, North, 6¼d. to 7d. Carbolic acid, 1s. 5d. to 1s. 6d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality 2½d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

North Middlesex Capital Issue.—Messrs. A. & W. Richards, acting on the instructions of the Directors, are offering for sale by tender £16,000 of additional ordinary stock of the North Middlesex Gas Company, on terms which are announced in our advertisement pages.

Brentford Price Increase.—The Directors of the Brentford Gas Company regret that, owing to the reduced yield from residual products and to increases in the rates of wages paid, they are compelled to raise the price of gas by 0·8d. per therm as from the date of the reading of the indices for the June quarter. This increase—which is equivalent to 4d. per 1000 c.ft.—will necessitate a corresponding reduction in the dividends paid to the stockholders.

New Preference Capital for Andover.—The Directors of the Andover Lighting and Power Company are inviting tenders for £5000 of 6 p.ct. redeemable preference stock; the money being required to pay off a bankers' loan and to provide increased carbonizing and condensing plant rendered necessary by the growing demand for gas. The minimum price of issue is par; and tenders must be received by the Company, at No. 13, Bridge Street, Andover, by noon of May 12.

STOCK MARKET REPORT.

It was not to be expected that the re-opening of the Stock Exchange after the Easter Holidays would be distinguished by any marked increase of business; but it cannot be said that markets were dull, though transactions were few. The possibility of sensational happenings in France tended to keep dealers and speculators alert until the formation of the Cabinet and the passing of the "crisis" afforded some relief. Anxiety with regard to the British Budget, and the rather stringent conditions which developed in the Money Market, discouraged speculative dealings. The gilt-edged market continued to feel the effect of the dearer money, and there was a slight shrinkage in quotations. In the Foreign Market, in spite of the financial uncertainty, French loans were steady. Home Rails were distinctly depressed. The announcement of the intention of the Great Western Railway to reduce its staff forthwith, in consequence of lower traffic receipts, came as a shock to the railway investment market, and prices weakened.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Apl. 17.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 5	5	5	Aldershot 5 p.c. max. C.	78—81	..	78—80
295,492	"	"	4	4	Do. 4 p.c. Pref.	71—76	..	..
2,551,868	"	Apl. 2	6½	6½	Alliance & Dublin Ord.	66—71	..	66¼—67½
374,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	63—68	..	..
300,000	5	Oct. 23	8	8	Bombay, Ltd.	5—5¼	..	5 7/16
100,000	10	Mar. 5	8½	8½	Bournemouth 5 p.c.	12—13	..	..
425,050	10	"	7	7	Do. B 7 p.c..	12¼—12½	..	11½
150,000	10	"	6	6	Do. Pref. 6 p.c..	11—12	..	..
50,000	Stk.	Jan. 8	3	3	Do. 3 p.c. Deb..	56—59	..	..
162,025	"	"	4	4	Do. 4 p.c. Deb..	76—79	..	..
992,045	"	Mar. 5	6 1/10	6 1/10	Brentford A Con.	95—105	−2½	..
990,500	"	"	6½	6½	Do. B New	95—105	−2½	..
76,000	"	"	5	5	Do. 5 p.c. Pref.	95—98	..	95
306,690	"	Dec. 18	4	4	Do. 4 p.c. Deb.	76—81	..	..
181,337	"	"	6	6	Do. 6 p.c.Rich.Red.Deb.	100—105	..	76
214,740	"	Mar. 5	11¼	12½	Brighton & Hove Orig.	165—170	..	..
244,200	"	"	8½	9½	Do. A Ord.	122—125	..	..
1,287,500	"	Feb. 19	5	5	Bristol 5 p.c. max..	96¼—97¼a	..	123½—124½
855,000	"	Mar. 19	8	7	British Ord.	112—117	..	93½—94
100,000	"	Dec. 18	7	7	Do. 7 p.c. Pref..	123—128	..	..
120,000	"	"	4	4	Do. 4 p.c. Red. Deb.	72—77	..	..
100,000	10	Dec. 18	8	6	Cape Town, Ltd.	7—8	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref..	6—7	..	..
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb..	71—76	..	6½
626,860	"	Feb. 19	6	6	Cardiff Con. Ord.	101—104	..	..
237,860	"	Jan. 8	7½	7½	Do. 7½ p.c. Red. Deb.	104—107	..	..
157,150	"	Feb. 19	5	6½	Chester 5 p.c. Ord.	89½—94½b	..	..
1,513,280	"	Mar. 5	6	5/14/8	Commercial 4 p.c. Cap.	87—90	−1	..
560,000	"	"	6	5⅜	Do. 3½ p.c. Cap.	87—90	..	..
475,000	"	Dec. 18	3	3	Do. 3 p.c. Deb.	57—60	..	..
800,000	"	14 Jan. 15	—	—	Continental Union, Ltd.	35—40	−2	58½
200,000	"	Dec. 18	7	7	Do. 7 p.c. Pref.	88—92	..	36
660,000	"	Mar. 5	6½	6½	Croydon sliding scale	100—103	..	..
284,975	"	"	5	5	Do. max. div.	83—86	..	..
492,270	"	Feb. 19	6	9	Derby Con.	110—112c	..	..
55,000	"	Jan. 8	4	4	Do. Deb.	74—76c	..	..
1,002,180	1	Jan. 22	6	4	European, Ltd.	7—8	..	7½
16,460,070	Stk	Feb. 19	5½	5½	Gas Light & Coke 4 p.c. Ord.	86—89	..	86½—88
2,600,000	"	"	3½	3½	Do. 3½ p.c. max.	62—65	..	63—64½
4,062,235	"	"	4	4	Do. 4 p.c. Con. Pref.	78—80	..	78½—79½
4,761,930	"	Dec. 18	3	3	Do. 3 p.c. Con. Deb.	59—62	..	60½—61½
130,000	"	—	10	10	Do. 10 p.c. Bonds	..	..	195
42,000	"	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	"	Mar. 19	6½	6½	Hastings & St. L. 5 p.c. Conv.	92—97	..	..
258,740	"	"	5½	5½	Do. 3½ p.c. Conv.	73—78	..	..
70,000	10	Sept. 25	10	10	Hongkong & China, Ltd.	16—17	..	..
86,600	Stk.	Mar. 5	10	10	Hornsey 7 p.c.	138—143	..	..
1,976,000	"	Nov. 20	30	10	Imperial Continental Cap..	179—184	..	..
263,950	"	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	71—74	..	180—182
235,244	"	Mar. 19	6½	6½	Lea Bridge 5 p.c. Ord..	96—101	..	73
2,127,340	"	Feb. 19	5½	5½	Liverpool 5 p.c. Ord.	87½—88½b	..	..
600,000	"	Mar. 19	7	7	Do. 7 p.c. Red. Pref.	103¾—104½b	+½	87½
165,736	"	Feb. 19	9	8	Maidstone 5 p.c. Cap.	122—132	..	..
63,480	"	Dec. 18	3	3	Do. 3 p.c. Deb..	54—59	..	..
75,000	5	Dec. 4	7	5	Malta & Mediterranean	4¼—4¾	..	..
541,920	Stk.	Nov. 20	4	4	Montevideo, Ltd.	62—67	+¼	..
2,061,315	"	Mar. 5	5	5	Newcastle & Gateshead Con.	79½—80½d	−½	65⅝
300,929	"	"	4	4	Do. 4 p.c. Pref..	72½—73½d	..	..
329,705	"	Dec. 18	3½	3½	Do. 3½ p.c. Deb.	68¼—69¼d	+½	..
13,000	10	Mar. 5	11	12	North Middlesex 10 p.c.	..	..	..
75,940	10	"	7 7/10	8⅝	Do. 7 p.c.	..	..	..
300,000	Stk.	Dec. 4	7	9	Oriental, Ltd.	102—107	..	..
188,120	"	Jan. 8	7¼	7¼	Plym'th & Ston'house 5 p.c.	109—114	..	..
60,000	50	Mar. 5	13	14	Portsea Island B	96—99	..	..
100,000	50	"	12	13	Do. C	93—98	..	..
2,289,909	1	—	—	—	Primitiva Ord.	10/0—11/0	+1/9	8/0—10/3
311,100	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb..	79—81	..	80
600,000	Stk.	Jan. 22	4	4	Do. 4 p.c. Red. Deb. 1911	63—65	..	63¼—64
220,335	"	Dec. 18	4	4	Do. B. Aires 4 p.c. Rd. Db.	65—67	..	..
321,670	"	"	4	4	Do. R'r P'te 4 p.c. Rd. Db.	65—67	..	..
150,000	10	Mar. 19	6	6	San Paulo 6 p.c. Pref.	7⅜—8⅛	..	..
125,000	50	Jan. 2	5	5	Do. 5 p.c. Red. Deb.	43—46	..	..
270,000	Stk.	Mar. 19	5½	5½	Sheffield A	102—104e	..	..
419,968	"	"	5½	5½	Do. B	102—104e	..	..
1,047,000	"	"	5½	5½	Do. C	102—104e	..	..
90,000	10	Oct. 23	8	6	South African	7—9	..	..
6,609,895	Stk.	Feb 19	5	6½	South Met. Ord.	94—96	..	..
1,895,445	"	Jan. 8	3	3	Do. 3 p.c. Deb.	59—62	..	94¼—95½
734,000	"	Mar. 5	6½	6½	Do. 6½ p.c. Red.Deb.	102½—104½	..	..
91,500	"	Mar. 5	8½	8½	South Shields Con.	135—136d	..	..
1,187,795	"	Feb. 19	6½	6½	South Suburban Ord. 5 p.c.	98—103	..	..
368,837	"	Dec. 18	5	5	Do. 5 p.c. Deb.	97—100	..	..
647,740	"	Nov. 6	5	5	South'mpt'n Ord. 5 p.c. max.	83—86	..	..
121,275	"	Dec. 18	4	4	Do. 4 p.c. Deb.	72—77	..	..
250,000	"	Mar. 5	7	7	Swansea 7 p.c. Red. Pref.	101—103	..	..
200,000	"	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb..	103—105	..	..
120,000	"	Feb. 19	8	8	Tottenham District A 5 p.c.	116—119	..	..
882,275	"	"	6½	6½	Do. B 3½ p.c.	98—101	..	117
181,255	"	Dec. 18	4	4	Do. 4 p.c. Deb.	75—79	..	98
258,251	"	Mar. 19	5	5	Tynemouth Con. and New	77—79d	..	..
197,294	"	Feb. 19	6¾	6¾	Uxbridge, Maidenhead, & Wycombe 5 p.c..	100—105	..	..
88,330	"	"	5	5	Do. 5 p.c. pref.	93—98	..	..
91,800	"	"	—	6½	Do. 5 p.c.Maidenh'd	90—95	..	..
30,000	"	Mar. 5	9½	9½	Wandsworth, Wimbledon, and Epsom—			
255,636	"	"	7½	7½	Wandsworth A 5 p.c.	130—135	−5	..
392,955	"	"	6/9/6	6/9/6	Do. B 3½ p.c.t..	110—115	−3	113—114
352,000	"	"	7⅞	7¾	Do. C and New	95—100	−2	95—99
98,000	"	"	7⅞	7¾	Wimbledon 5 p.ct.	105—110	−4	..
88,416	"	Dec. 18	3	3	Epsom 5 p.ct..	115—120	−2	115
					3 p.c. Deb.	57—60	..	..

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. * Ex. div.

The Industrial Market was steady, but there was very little business done. Courtaulds and Imperial Tobaccos were again exceptions. The price of these two companies' shares have been steadily advancing for some time, and there has been speculation as to which will reach the £5 mark first.

In the Gas Market the depression continues. It will be seen from the Table that Commercial 4 p.ct. and all the Wandsworth stocks fell during the week. Although these stocks at the prices quoted are good investments, there is a possibility of a still further drop before the inevitable reaction occurs. The Brentford stocks were also marked down by as much as 2½ points. In view of the excellent terms of conversion provided by the Gas Light and Coke Company's Bill (which is now practically certain of becoming an Act), the fall is very remarkable. Primitiva ordinary advanced by 1s. 9d., to 10s.-11s.—a jump of no less than 20 p.ct. on the former average price, and, in view of the state of the Company's accounts, would, to say the least, seem to be scarcely justified.

An issue of interest to gas stock investors is that of the Tottenham District Company, who are offering £150,000 5½ p.ct. Irredeemable Preference Stock. Tenders must be received by May 1, and the minimum price of issue is par.

The following transactions were recorded during the week:

On Tuesday, Alliance and Dublin 66¼ *ex* div., Bombay 5 7/16, Brighton and Hove "A" 123¾, 124½, Bristol 93½, 94, Commercial 3 p.ct. debenture 58½, Gas Light and Coke 87, 87¼, 87½, 88, 4 p.ct. preference 78¼, 78¾, Imperial Continental 180½, 182, 3½ p.ct. debenture 73, Primitiva 8s. 6d., Tottenham "B" 98. Supplementary prices, Liverpool 5 p.ct. 87¼.

On Wednesday, Aldershot "C" 78, Alliance and Dublin 67½ *ex* div., Bournemouth 6 p.ct. preference 11⅜, Cape Town 4½ p.ct. preference 6¼, Gas Light and Coke 87, 87⅛, 87½, 3½ p.ct. maximum 63, 63¼, 63⅜, 4 p.ct. preference 79⅜, 3 p.ct. debenture 60½, 60⅝, 61, Montevideo 65⅜, Primitiva 8s. 10½d., 9s., South Metropolitan 94⅜, 95, 95¼, Tottenham "A" 117, Wandsworth "B" 113, 114. Supplementary prices, British, Norwich, 3½ p.ct. mt. debentures 62, 4 p.ct. mt. debentures (Act of 1896) 71½, 72, Wandsworth New 95.

On Thursday, Aldershot "C" 80, Continental Union 36, Gas Light and Coke 86¼, 86¾, 87¼, 87⅛, 3½ p.ct. maximum 64½, 4 p.ct. preference 79, 79½, 3 p.ct. debenture 61, 61½, Imperial Continental 181½, Montevideo 65⅜, Primitiva 8s., 9s. 3d., 9s. 6d., South Metropolitan 94⅜, 95, Tottenham "A" 117. Supplementary prices, Gas Light 10 p.ct. bonds 195, Grays and Tilbury "B" 8⅛, 8¼, Wandsworth New 95.

On Friday, Brentford "B" 95, 4 p.ct. debenture 76, Continental Union 36, European 7¼, Gas Light and Coke 86½, 86¾, 87¼, 87⅛, 3½ p.ct. maximum 64, 4 p.ct. preference 79⅜, Imperial Continental 180, 181, 182, Primitiva 9s. 6d., 9s. 9d., 10s., 10s. 3d., 4 p.ct. 1st debentures 80, 4 p.ct. debenture 63½, 64, South Metropolitan 95¼, Wandsworth, Epsom, 115. Supplementary prices, Brentford 6 p.ct. mortgages 99, Hongkong and China 5 p.ct. debentures 92, Wandsworth new 96½, 97½, 98, 99, Watford 3½ p.ct. consolidated 90, 91.

As we have mentioned above, stringent conditions developed last week in the Money Market. On Friday 4 p.ct. had to be paid at the start for fresh money; but the position eased later, and 3⅜ p.ct. was the general rate. Treasury Bills showed an increase in the average rate at which they were allotted—£4 4s. 2·38d., or 10·2d. p.ct. above that of the previous week.

The Foreign Exchange Market was inactive, except for the improvement in the French franc. The rate, which had touched 94 earlier in the week, dropped to 91.40 on Saturday. Belgian francs were 94.85, and Italian lire 116⅞. Sterling was steady at 4·78 9/16.

Silver, with Indian and Continental selling, is inclined to fall, and the price for cash is 31 7/16d. per oz. Gold was unaltered at 86s. 7d. per oz., with practically no dealings.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on March 5. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3¼ p.ct. at notice.